Ministry of Energy
Mines and Petroleum
Resources

# ANNUAL REPORT

# 1983

**Honourable Stephen Rogers**
Minister of Energy,
Mines and Petroleum Resources

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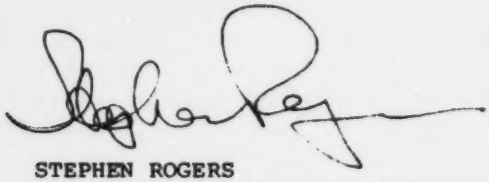
To the Honourable ROBERT GORDON ROGERS
Lieutenant Governor of the Province of British Columbia

MAY IT PLEASE YOUR HONOUR:

The Annual Report of the Ministry of Energy, Mines and Petroleum Resources for the year 1983 is herewith respectfully submitted.



STEPHEN ROGERS

Minister of Energy, Mines and
Petroleum Resources

Office of the Minister of Energy, Mines and
Petroleum Resources

March 1985

The mining, petroleum and energy industries of British Columbia are full of excitement and optimism in normal times. These times, however, are not normal. During 1983, the world recession continued to depress our vital export markets, which in turn compounded domestic difficulties in the provincial economy.

Nevertheless, by the end of 1983, we had passed some significant signposts on the road to economic recovery. The massive northeast coal project was completed, on time and on budget. The government, with this ministrys advice, enunciated a new natural gas pricing and marketing regime giving the private sector more freedom to respond to market conditions. A new oil play was being delineated in the extreme northeast. New markets were appearing for our surplus electrical power south of the border.

There is reason to be optimistic again.

Honourable Stephen Rogers
Minister of Energy, Mines and
Petroleum Resources

## TABLE OF CONTENTS


| | Page |
|---|---|
| Introduction | 9 |
| Revenue to the Crown | 10 |
| B.C. Hydro/BCUC/BCPC | 11 |
| New Legislation in 1983 | 12 |
| Provincial Energy Trends in 1983 | 13 |
| The Mining Industry in 1983 | 20 |
| The Petroleum Industry in 1983 | 26 |
| ENERGY RESOURCES DIVISION | 33 |
| Policy Development Branch | 36 |
| Project Analysis Branch | 39 |
| Forecasts and Special Projects Branch | 42 |
| Conservation and Renewable Energy Branch | 43 |
| MINERAL RESOURCES DIVISION | 45 |
| Inspection and Engineering Branch | 48 |
| Mechanical/Electrical Section | 48 |
| Geotechnical Section | 49 |
| Reclamation Section | 50 |
| Mine Rescue and First Aid Section | 51 |
| Environmental Control Section | 52 |
| Coal Section | 52 |
| Mining and Petroleum Roads Program | 53 |
| Geological Branch | 54 |
| Geoscience Projects Section | 55 |
| Applied Programs Section | 56 |
| Resource Data and Analysis Section | 57 |
| Analytical Laboratory | 58 |
| Mineral Policy and Evaluation Branch | 60 |
| Mineral Titles Branch | 63 |
| PETROLEUM RESOURCES DIVISION | 65 |
| Engineering and Operations Branch | 68 |
| Development Engineering Section | 68 |
| Drilling and Production Section (District Operations) | 69 |
| Reservoir Engineering Section | 70 |
| Geological Branch | 73 |
| Economic Geology Section | 73 |
| Geophysical Section | 74 |
| Reservoir Geology Section | 74 |
| Petroleum Titles Branch | 76 |
| Offshore Administration Branch | 77 |
| Mediation and Arbitration Board | 79 |
| FINANCE AND ADMINISTRATION DIVISION | 81 |
| Mineral Revenue Branch | 84 |
| Financial Services Branch | 85 |
| Administration and Publications Branch | 86 |
| Data Services Branch | 87 |
| Personnel Services Branch | 88 |

# Introduction

The Ministry of Energy, Mines and Petroleum Resources administers British Columbia's mineral, coal, oil, natural gas, hydro-electric, and other energy resources. Its mandate embraces a wide range of responsibilities. At one and the same time the ministry promotes orderly development while encouraging conservation, provides services to industry while regulating its operation, ensures safety, protects the environment, collects revenue, formulates strategy, and advises government.

The ministry consists of four divisions: Energy Resources, Mineral Resources, Petroleum Resources, and Finance and Administration. These divisions are made up of specialized branches, which may be further subdivided into sections. This report follows the ministry structure closely.

Information of a more detailed nature is available in other annual publications of the ministry: *Mineral Resources Division Summary of Operations* and *Petroleum Resources Division Summary of Operations*.

Requests for further information should be addressed to:

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Victoria, B.C.
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Telephone: (604) 387-5178

# Revenue to the Crown

TABLE 1

DIRECT REVENUE TO THE PROVINCIAL GOVERNMENT
FROM THE PETROLEUM AND MINERAL INDUSTRIES

| | 1982 $ | 1983 $ |
|---|---|---|
| **PETROLEUM INDUSTRY** | | |
| Crown reserves disposition | 16,724,133 | 26,014,217 |
| Rental and fees | 31,126,234 | 40,371,888 |
| Crown royalties | 76,180,767 | 89,142,226 |
| BCPC net revenue from sales | 155,000,000 | 102,580,000 |
| **MINING INDUSTRY** | | |
| Claims, fees and rentals | 6,814,707 | 8,757,410 |
| Royalties | 7,097,817 | 7,839,590 |
| Mineral taxes | 21,504,685 | 13,538,262 |
| Land Service Rentals and royalties | 1,811,830 | 2,858,754 |
| **TOTAL** | **316,260,173** | **291,102,347** |

# B.C. Hydro/BCUC/BCPC

The Minister of Energy, Mines and Petroleum Resources is responsible for the British Columbia Hydro and Power Authority, the British Columbia Utilities Commission and the British Columbia Petroleum Corporation. These three Crown agencies present their own annual reports to the legislature, and therefore are not dealt with in detail here. In brief:

- B.C. Hydro is the largest utility in British Columbia. It produces and delivers most of the electricity used in the province and exports surplus electric power to the United States. It also operates gas distribution systems in the Lower Mainland area and in the city of Victoria;

- the B.C. Utilities Commission regulates rates, standards, and operations of public utilities, including B.C. Hydro. At the government's direction it holds public hearings to examine proposed energy development projects or removals of energy resources from the province;

- the B.C. Petroleum Corporation's primary function is to market the natural gas produced in British Columbia by purchasing gas from producers and selling it to Westcoast Transmission Co. Ltd. Net revenue from these transactions is paid into the provincial treasury.

# New Legislation in 1983

In 1983 the unproclaimed provisions of the *Mines Act* and its regulations, except sections 37 and 38 (3) to (7), were brought into force, thereby repealing the *Coal Mining Regulation Act* and the *Mining Regulation Act*. The provisions of the *Mines Act* deal with the regulation and supervision of mines in the province, including such matters as exploration, reclamation, development, operation, closure and abandonment of mines and mining property. In addition, it provides for inspection of mines generally, as well as accident investigation, control of dangerous conditions, and procedures in the event of accidents. It also deals with the safety, health and employment of persons in or about mines.

By additions to section 52 of the *Hydro and Power Authority Act*, the British Columbia Hydro and Power Authority was made subject to the *Public Sector Restraint Act* and the *Financial Administration Act*. A number of minor changes were made to section 42 of the Act dealing with borrowing by the Authority by virtue of the *Provincial Treasury Financing Amendment Act*. Sections 10 and 11 of the *Petroleum Corporation Act* were also amended under the *Provincial Treasury Financing Amendment Act* which streamlined the procedures respecting borrowing operations. Finally, there were a number of minor amendments to the *Coal Act*, the *Geothermal Resources Act*, the *Hydro and Power Authority Act*, the *Mineral Land Tax Act*, the *Mineral Processing Act*, the *Mineral Resource Act*, the *Mines Act*, the *Mining (Placer) Act*, the *Petroleum and Natural Gas Act*, the *Petroleum Corporation Act*, the *Petroleum Underground Storage Act*, and the *Utilities Commission Act* ancillary to the enactment of a new *Regulations Act*.

# Provincial Energy Trends in 1983

The Energy Resources Division of the ministry is concerned with creating and maintaining a favourable economic, financial, and policy environment for energy production and consumption in the province, in order to implement the government's role as steward of those resources on behalf of the people of the province. Most of the work of the division is therefore carried out in the context of both recent developments and projected long-term trends in energy supply and requirements. A key policy concern is security of energy supply for British Columbia. That concern embraces energy production, conservation, and conversion to forms of energy in which the province is self-sufficient.

Table 2 shows actual 'end use' energy consumption (by energy type and sector) for 1982 and estimates for 1983; the data is summarized in the British Columbia Energy Consumption graph (Fig. 1).

Looking first at oil, the province's requirements are estimated to have declined by approximately seven per cent from 1982 to 1983, continuing a short-term trend which started in 1980. Requirements are, however, expected to increase again beginning in 1988.

Oil provides 41 per cent of the province's total energy needs, but only 20 per cent of B.C.'s crude oil requirements are supplied from within the province. With projected B.C. crude oil supplies virtually constant, and with requirements increasing, the supply/demand balance will become increasingly unfavourable unless new reserves are discovered. This oil deficit is made up primarily through transfers of crude oil and refined petroleum products from Alberta, and is evident in the Projected Oil Requirements And Supply graph (Fig. 2).

In 1983, pipeline exports of natural gas to the United States continued a decline which started in 1980. This deterioration in markets has depressed the British Columbia natural gas exploration, development and production industry. In its continuing attempts to improve markets for natural gas, the province in 1983 explored the feasibility of expanding domestic gas markets, including gas transmission to Vancouver Island, and continued the active

TABLE 2

BRITISH COLUMBIA END USE CONSUMPTION BY ENERGY TYPE AND BY SECTOR, 1982 AND 1983
Petajoules (PJ)*

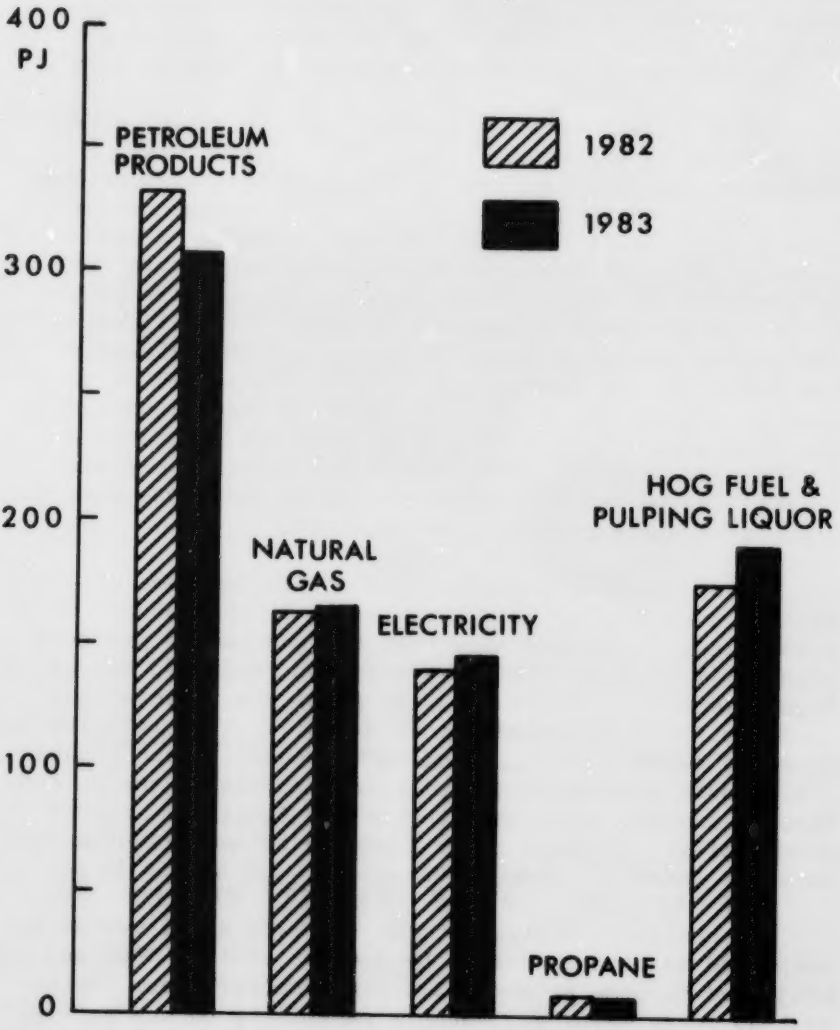
| | Refined Petroleum Products | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Motor Gasoline | LFO | Diesel | HFO | Aviation Fuel | Natural Gas | Electricity | Propane | Hog Fuel and Pulping Liquor | Total |
| **1982 (Actual)** | | | | | | | | | | |
| Road and Urban Transport | 145.1 | - | 25.7 | - | - | -** | -** | -** | - | 171.9 |
| Marine | - | - | 12.2 | 24.1 | - | - | - | - | - | 36.3 |
| Airlines | - | - | - | - | 20.7 | - | - | - | - | 20.7 |
| Railways | - | - | 10.2 | - | - | - | - | - | - | 10.2 |
| Total Transportation | 145.1 | - | 47.9 | 24.1 | 20.7 | -** | -** | -** | - | 240.0 |
| Industrial | - | 1.5 | 27.1 | 25.2 | - | 66.6 | 72.6 | 1.2 | 174.6 | 368.7 |
| Residential*** | - | 20.2 | 2.9 | 0.4 | - | 61.3 | 36.0 | 2.9 | - | 123.7 |
| Commercial and Other Institutional | - | 5.4 | 5.5 | 3.4 | - | 34.2 | 30.1 | 3.3 | - | 81.8 |
| Total | 145.1 | 27.0 | 83.5 | 53.1 | 20.7 | 162.1 | 138.8 | 8.2 | 174.6 | 813.2**** |
| **1983 (Estimate)** | | | | | | | | | | |
| Industrial | - | 1.5 | 28.0 | 23.8 | - | 63.7 | 75.4 | 1.2 | 191.0 | 384.2 |
| Road and Urban Transport | 141.1 | - | 24.8 | - | - | -** | -** | -** | - | 167.1 |
| Marine | - | - | 13.0 | 9.0 | - | - | - | - | - | 22.0 |
| Airlines | - | - | - | - | 20.1 | - | - | - | - | 20.1 |
| Railways | - | - | 9.9 | - | - | - | - | - | - | 9.9 |
| Total Transportation | 141.1 | - | 47.7 | 9.0 | 20.1 | -** | -** | -** | - | 219.1 |
| Residential*** | - | 18.4 | 2.9 | 0.4 | - | 65.0 | 38.7 | 2.6 | - | 128.0 |
| Commercial and Other Institutional | - | 3.9 | 3.6 | 4.3 | - | 34.0 | 30.4 | 2.5 | - | 78.8 |
| Total | 141.1 | 23.9 | 82.2 | 37.5 | 20.1 | 163.4 | 144.7 | 7.3 | 191.0 | 810.0**** |

* A petajoule is a standard metric unit of energy equivalent to 25,426 cubic metres of cubic oil, 27 million cubic metres of natural gas or 280 gigawatt hours of electricity
** Less than 1 petajoule.
*** Includes apartments and agriculture.
**** Rows or columns may not add to totals because of rounding.

FIGURE 1

# B.C. ENERGY CONSUMPTION

## (PETAJOULES)



evaluation of the Western LNG (liquefied natural gas) Project further to its 1982 decisions to allocate surplus gas to this project and to a potential fertilizer manufacturing facility. Gas marketing initiatives will also assist in reducing oil requirements in the province.

At the beginning of 1983, the current surplus of marketable gas in the province amounted to 70.5 billion cubic metres. This was the gas reserve in excess of that required for domestic market security, amounting to 25 times annual consumption, plus gas required for future use on Vancouver Island, and the total gas remaining on the province's export commitment under export licence GL-41.

This current surplus, together with reserves expected to be found in the future[1], constitute the future available supply as defined by the Extended Reserves Test. This test is the criterion adopted by the government to determine a future surplus. In 1982, results of the Extended Reserves Test indicated sufficient future surplus to provide: 51 billion cubic metres for pipeline exports after licence GL-41 terminates in 1989; 11.3 billion cubic metres for an ammonia/urea facility; and 25 per cent of the feedstock for the Western LNG Project (increased to 50 per cent in 1983). The government approved the allocation of the surplus to these uses and, in addition, approved a further 11.3 billion cubic metres for pipeline exports, conditional on there being a surplus in the 1990s when this commitment was expected to be required.

In addition to ensuring that enough reserves of gas will be available to meet commitments in the future, it is also necessary to make sure that the gas can be produced when it is needed. The chart entitled Projected Natural Gas Requirements and Supply (Fig. 3) shows the forecast gas producibility, or annual supply capability, in relation to: domestic requirements, including Vancouver Island demand and the ammonia/urea facility; pipeline exports to the United States; and the commitment to the LNG facility. Future producibility is shown to be adequate to meet requirements until at least the year 2000.

Electricity requirements on the B.C. Hydro system are estimated to have increased by 3.4 per cent in 1983 and are projected to grow at about 2.5 per cent per annum for the next 15 years (Fig. 4). Supply capability on the B.C. Hydro system will increase in 1984 with the commissioning of the Revelstoke hydro-electric generating project. With Revelstoke, B.C. Hydro will have surplus capability until about 1997, at which point another supply source is projected to be required.

[1] Based on projected buildup of drilling activity to 300 wells per year by 1985/86.

FIGURE 2

# PROJECTED OIL REQUIREMENTS AND SUPPLY

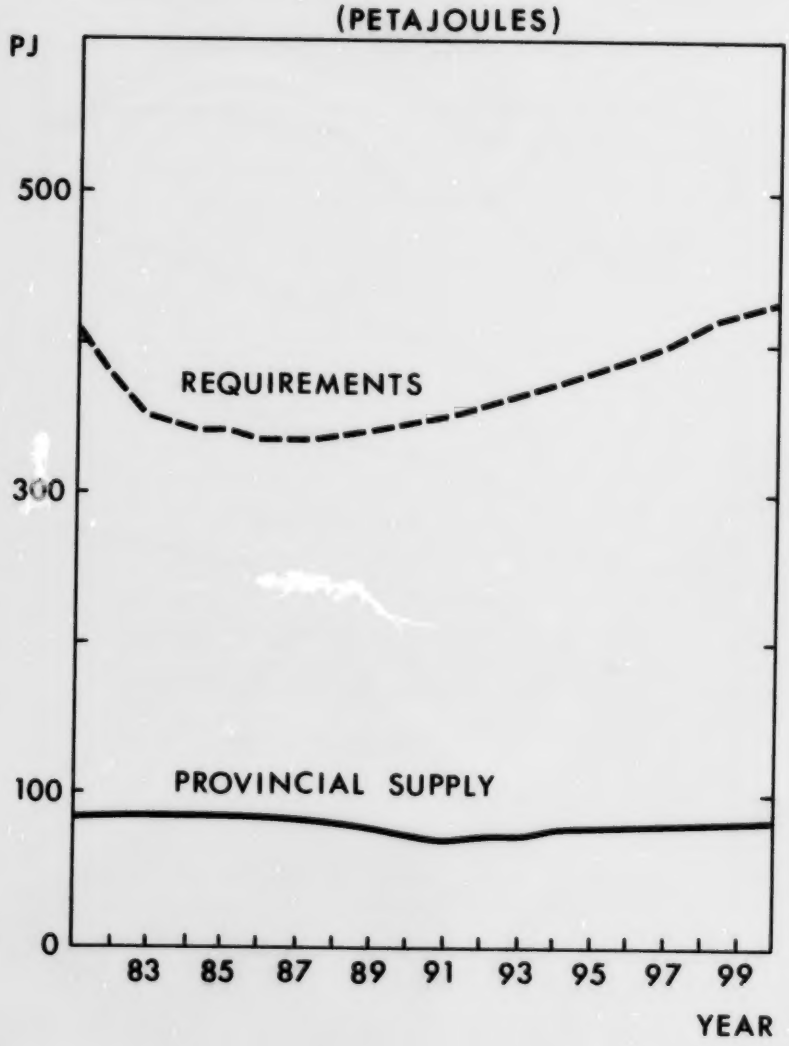


FIGURE 3

# PROJECTED NATURAL GAS REQUIREMENTS AND SUPPLY

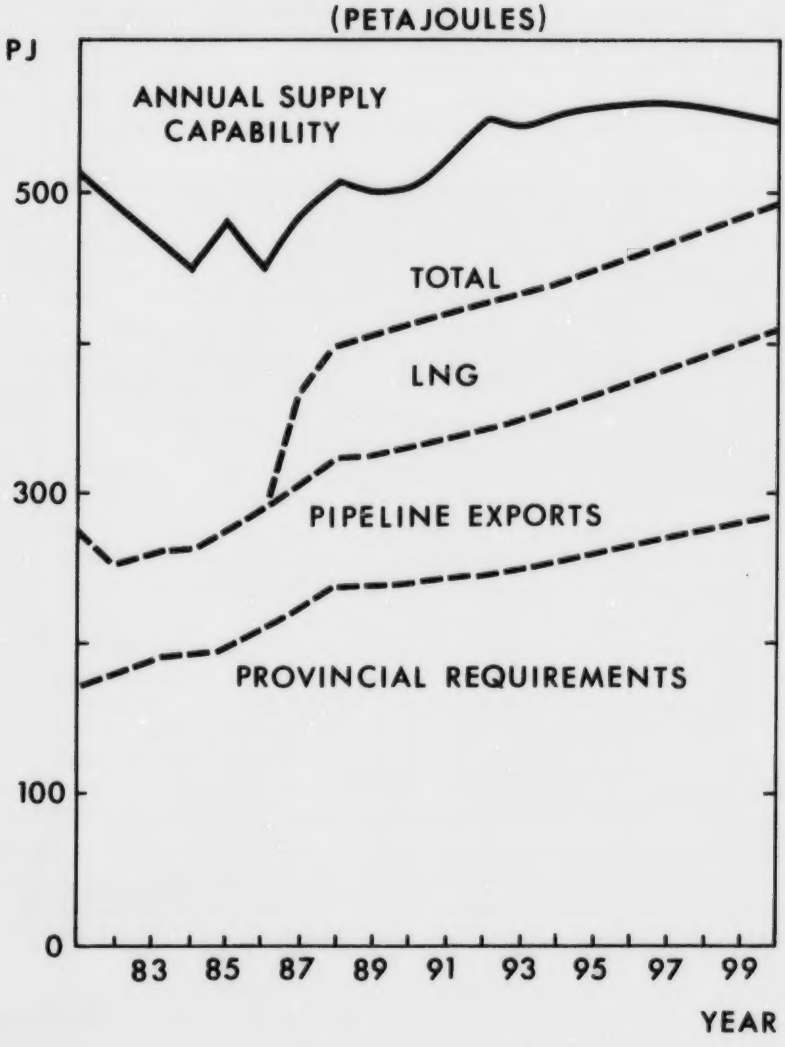
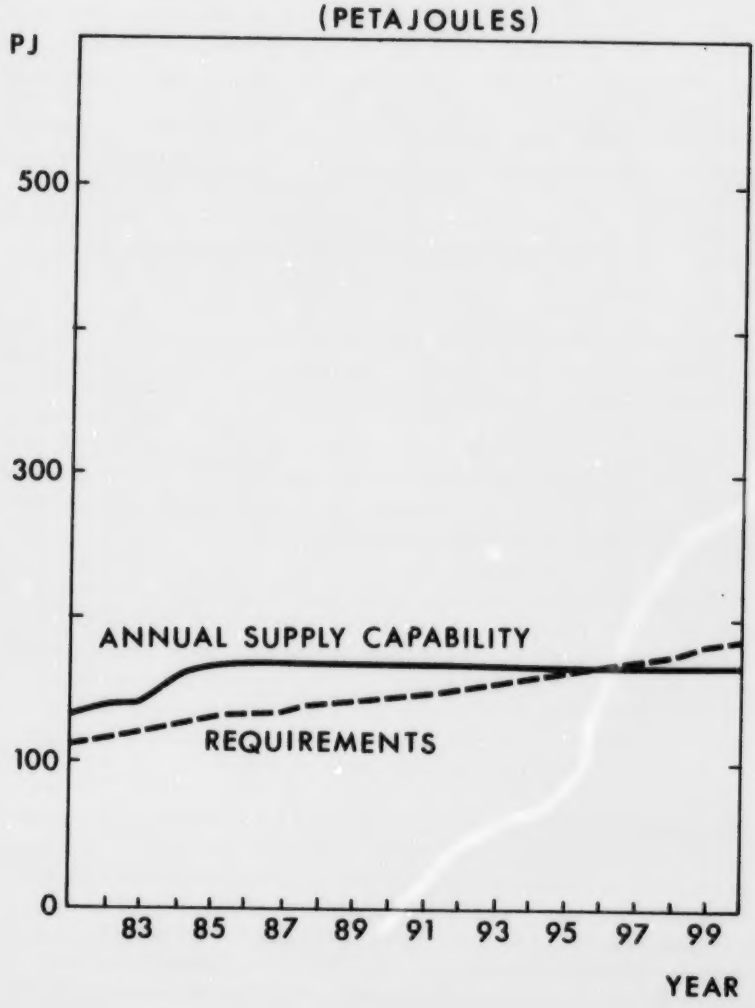


FIGURE 4

# PROJECTED B.C. HYDRO ELECTRICITY REQUIREMENTS AND SUPPLY



# The Mining Industry in 1983

The value of solid mineral production in British Columbia totalled $1,957.7 million in 1983. This represents an increase of 3.9 per cent over the $1,884.2 million reported for 1982, the lowest value of production in this province since 1978. The increase in 1983 was primarily due to the higher prices received for copper and precious metals and to increases in the production of almost all the major minerals produced in B.C. except molybdenum and silver.

British Columbia is Canada's largest exporter of copper, molybdenum, and coal. Of these three, copper was the province's only major mineral commodity to increase in value of production from 1982. Lower prices led to the first decline in value of coal production since 1976, despite increased production during 1983. Molybdenum mining continued to be plagued by weak demand as a result of the slowdown in world steel production.

Many third-world mineral producers continued to glut the market with commodities during 1983. In British Columbia, mineral resource production and employment were cut back considerably in spite of the economic recovery that started in the latter half of 1983 in Canada and the United States. Many mining companies in the province incurred losses on their operations during the year.

At least three of British Columbia's exploration indicators showed dramatic improvements in 1983. Mineral claims staked were at an all-time high of 106,683 units, an increase of 152 per cent over 1982; the number of placer lease applications in 1983 was 1,787, a 24-per-cent increase over 1982; and the number of exploration companies active in the province was estimated at 800, double the number in 1982.

Overall production expenditures, however, showed a slight decrease during 1983 compared to the previous year. Expenditure on coal exploration was down by almost 50 per cent as the worldwide demand for coal weakened further. In the metallic minerals sector, the exploration impetus in 1983 was for precious metals and massive sulphide-type base metal deposits. Exploration for industrial minerals remained at approximately the same level as in 1982.

Table 3 summarizes the value of mineral production and provincial revenues derived from the mining industry since 1980.

TABLE 3

VALUE OF SOLID MINERAL PRODUCTION

| | 1980 $ | 1981 $ | 1982 $ | 1983 $ |
|---|---|---|---|---|
| Metals | 1,429,002,180 | 1,246,682,535 | 1,057,488,380 | 1,104,040,121 |
| Coal | 461,492,857 | 554,271,292 | 566,878,240 | 555,789,196 |
| Structural Materials | 242,325,657 | 200,786,479 | 164,156,644 | 208,401,528 |
| Industrial Minerals | 115,926,007 | 122,464,842 | 95,544,218 | 89,496,434 |
| **TOTAL** | **2,248,746,701** | **2,124,205,148** | **1,884,167,482** | **1,957,727,279** |

PROVINCIAL REVENUE FROM THE MINING INDUSTRY

| | 1980 $ | 1981 $ | 1982 $ | 1983 $ |
|---|---|---|---|---|
| Claims | 3,492,635 | 4,178,169 | 3,860,320 | 2,704,183 |
| Coal Licences and Rentals | 4,479,000 | 3,128,752 | 2,954,387 | 6,053,227 |
| Coal Royalties | 5,228,891 | 6,011,820 | 7,097,772 | 7,839,590 |
| Iron Ore Royalties | 148,182 | 24,295 | 45 | 0 |
| Mineral Land Taxes | 10,403,808 | 10,999,205 | 13,989,511 | 14,570,073 |
| Mineral Resource Taxes | 79,861,651 | 32,153,394 | 1,136,895 | (-1,942,642)* |
| Mining Taxes | 18,460,978 | 15,747,983 | 6,378,279 | 910,831 |
| Rental and Royalties on Industrial Minerals and Structural Materials | 997,212 | 1,492,601 | 1,811,830 | 2,858,754 |
| **TOTAL** | **122,892,357** | **73,736,219** | **37,229,037** | **32,994,016** |

* Estimated taxes were higher than taxes payable, resulting in a credit refund.

**Metals**

Total value of metal production in 1983 was $1,104.0 million, an increase of 4.4 per cent over the $1,057.5 million reported in 1982, but considerably lower than the 1981 level of $1,246.7 million. The following is an outline of the performance of the province's major metal commodities during 1983.

Copper remained by far the most important metal in the provincial mineral sector during 1983. Prices firmed up noticeably to $1.979 per kg in 1983 from the extremely low $1.769 per kg experienced in 1982. Production also increased to 282.8 million kg from 279.9 million kg in 1982. Most of the copper concentrates produced in the province are shipped to Japan and other world markets, with only a minor portion of the material smelted domestically.

Molybdenum markets were extremely weak in 1983, with provincial production declining by almost one-third from the 1982 level, to 10.2 million kg, the lowest in nine years. The 1982-83 decrease of more than 40 per cent in the value of molybdenum production was largely attributable to the continued slide in prices, reaching a low of $8.61 per kg in 1983 compared to $10.51 per kg a year earlier. Faced with mounting losses, both primary molybdenum producers in British Columbia were closed down in 1983. With no strengthening of prices in sight, these closures are expected to continue indefinitely.

Europe is the primary destination for British Columbia molybdenum exports, with Japan and the United States sharing most of the remaining B.C. production.

Precious metals were the bright spot during the year. Gold production increased from 7.7 million grams in 1982 to almost 8.0 million grams in 1983. This, coupled with an increase in prices from $15.39 to $16.41 per gram, led to an increase of 10.7 per cent in the total value of gold produced during 1983.

Silver production in the province dropped from 499.6 million grams in 1982 to 402.0 million grams in 1983. However, the decrease in production was more than made up for by gains in prices, particularly during the first three quarters of 1983. The price increase, from $0.32 per gram in 1982 to $0.45 per gram in 1983, represents an impressive 42.5-per-cent rise. As a result, the value of silver production in British Columbia went up by 13.6 per cent, to $179.9 million in 1983 from $158.3 million in 1982.

Zinc production increased significantly during 1983. The total value of production grew by more than 25 per cent to $79.6 million in 1983 from $63.6 million in 1982, although zinc prices decreased slightly.

Reflecting the decline of lead used in battery production, lead prices continued their downward movement, but production of the commodity in the province rose by 34.9 per cent during 1983. As a result, the value of lead production grew to $48.8 million, an increase of 13.5 per cent over the $43.0 million reported in 1982. Westmin Resources Ltd.'s expansion of its mine at Buttle Lake should increase provincial lead and zinc production in 1984.

The Cominco smelter at Trail is the world's largest lead-zinc production complex. During 1983, Cominco Ltd. completed the first phase of a modernization and expansion program and started production in its new zinc electrolytic and smelting plant in October, 1983.

Exploration for metals was most active in the northwest region of the province during 1983. The Windy-Craggy prospect of Falconbridge Nickel Ltd. and Geddes Resources Ltd. was confirmed as a world-class volcanogenic copper-cobalt deposit with significant gold and zinc values. The Midway carbonate shale-hosted silver-zinc-lead massive sulphide deposit of Regional Resources Ltd. was the target of a major drilling program. Other major drilling programs were carried out at the Tillicum Mountain gold prospect by Esperanza-La Teko Resources Ltd. and at a new gold-silver discovery (Rea gold) west of Adams Lake by Corporation Falconbridge Copper.

In May, 1983, Noranda Mines Ltd. opened its new Goldstream mine near Revelstoke. The surface drilling program indicated that the property contains 3,177,903 tonnes grading 4.49 per cent copper, 3.24 per cent zinc, and 0.68 ounce per tonne silver. The maximum production rate is expected to be 1,360 tonnes per calendar day and mill equipment has been sized to handle this throughput accordingly.

**Coal**

Coal remained the most valuable solid mineral produced in British Columbia in 1983, after surpassing copper in the value of production in 1982. The total value of coal production, however, declined slightly because of the lower prices received. Total coal production was valued at $555.8 million in 1983, compared to $566.9 million in 1982.

Historically the largest coal operations in British Columbia have been in the Crowsnest Coalfield of the southeast, which produced more than 90 per cent of total provincial production. Westar Mining Ltd., a subsidiary of B.C. Resources Investment Corporation (BCRIC), is the province's largest producer. Together Westar, Fording Coal Ltd., Crows Nest Resources Ltd., and Byron Creek Collieries Ltd. produced most of the province's coal to date. The Bulkley Valley Collieries Ltd. mine at Telkwa was a minor producer of thermal coal.

In late 1983, major coalfields in the northeast section of the province began production. Production from the Quintette and Bullmoose mines will significantly increase coal output in British Columbia.

Japan remained the largest market for British Columbia coal in 1983. Cutbacks by Japanese steel mills in their requirements for B.C. coal affected both Westar and Fording Coal operations. Diversification of coal markets continued during 1983, with sales of significant volumes to Korea,

Brazil, Spain, Denmark, and Italy. Coal sales to Canadian markets were also maintained.

Coal exploration programs were at a lower level in 1983 as a result of drilling programs that matured and properties that entered the development phase. A total of $9 million was spent on coal exploration in 1983, with major activities taking place on the Mount Klappan and Telkwa deposits in the northwest part of the province. Exploration also continued at or near major deposits that had recently come on stream in the southeast and northeast coalfields.

The major development projects for coal were in the northeast coalfields, where major construction at the two mine sites and the adjacent townsite was completed in 1983. The latter part of 1983 marked the opening of Denison Mines Ltd.'s Quintette and Teck Corporation's Bullmoose mines. Total production capacity of metallurgical and thermal coal is expected to be 6.5 million tonnes per year from Quintette and 2.3 million tonnes from Bullmoose.

In the southeast, two mines which had begun production in 1982, Westar Mining Ltd.'s Greenhills and Crows Nest Resources Ltd.'s Line Creek, were officially opened in 1983.

**Industrial Minerals**

The value of industrial minerals produced in the province declined from $95.6 million in 1982 to $89.5 million in 1983, a decrease of 6.4 per cent. This decrease was due almost entirely to the lower average prices received for asbestos and sulphur in 1983.

Asbestos produced at the Cassiar mine continued to be the province's most valuable industrial mineral in 1983. Sulphur is produced as a byproduct from Cominco Ltd.'s roasting operations and Petrosul International Ltd.'s sour gas production in the Peace River area.

Westroc Industries Ltd.'s Windermere mine produced most of the province's gypsum during 1983. Production of barite came mainly from Mountain Minerals Co. Ltd.'s Parson mine in the east Kootenays, Baroid of Canada Ltd.'s operation at Golden, and Barwell Resources Ltd.'s barite mine near Windermere. Nicholson Silica reopened in 1983, following receipt of a 30,000-tonne order from the Wanatchee ferrosilicon plant. There were numerous provincial producers of crushed or ground rock products, but production was dominated by the International Marble and Stone Co. Ltd. operation at Nelson. Many other industrial minerals were produced by small mining operations; most of these were operations with production value of $100,000 or less.

The largest exploration program for industrial minerals during 1983 was undertaken by Eaglet Mines Ltd. on their large, low-grade fluorite-silver deposits near Quesnel Lake. Other significant exploration and development programs for industrial minerals in 1983 were on Canrock's quartzite deposit near Babette Lake, Imasco Ltd.'s limestone quarry in the Lost Creek area south of Salmo, Tri-Lime Resources Ltd.'s Redrocky Creek limestone deposit, and Baymag Mines Ltd.'s magnesite deposit north of Radium Hot Springs.

**Structural Materials**

Most structural materials in British Columbia are produced near major urban centres and are consumed by the construction industry. The production value of these materials rose from $164.2 million in 1982 to $208.4 million in 1983, reflecting a modest recovery in the construction sector.

Sand, gravel, and cement accounted for more than 80 per cent of structural materials production in the province. Other important structural materials included limestone, clay products, riprap, crushed rock, and building stone. Many of these products were produced at a large number of small quarries, some of which had intermittent production.

**Northwest Mineral Development**

Staff of the Mineral Resources Division participated in an Inter-Ministry Task Force directed by the Cabinet Committee on Economic Development to examine development opportunities in the northwest region of the province. A series of reports was released in October, 1983, establishing a general framework for future development of significant mineral deposits. The task force identified three most promising areas for mineral development: Kutcho Creek resource area (copper, zinc), Mount Klappan resource area (anthracite coal), and Schaft Creek/Stikine resource area (copper). During 1983, Gulf Canada Resources Inc. actively continued its development plan for the Mount Klappan project. A prospectus was expected to be submitted to the Coal Guidelines Steering Committee early in 1984.

The Mineral Resources Division expects to be closely involved with the mining industry in future discussions and planning for development of the region.

# The Petroleum Industry in 1983

The slowdown in petroleum industry activity in British Columbia, which began in 1981, continued through 1983.

Activity was adversely affected by economic factors, especially the reduced export market for natural gas and industry's projection of inadequate return on drilling and production operations due to government pricing and taxation policies. Steps were taken by the government to address this situation by approving many of the recommendations made by a Gas Marketing Study Group to improve the institutional and financial frameworks underlying the production and marketing of B.C. natural gas. However, it was recognized that the expansion of sales would be difficult to achieve in the short term.

## Drilling

Some recovery to the decline of drilling operations over the past three years was indicated in 1983. The annual statistics generally showed a decrease, but towards year's end, activity was making significant gains based upon a shallow oil discovery made during the previous winter in the Desan area, northeast of Fort Nelson. This upturn was reflected in the land disposition results, the increased level of geophysical activity and the number of well authorizations issued during the latter part of 1983.

TABLE 4

VALUE OF HYDROCARBON PRODUCTION IN 1983

| | $ |
|---|---|
| Crude oil | 402,075,945 |
| Field condensate | 3,411,136 |
| Marketable natural gas | 455,187,148 |
| Gas plant liquids | 38,677,155 |
| **Total** | **899,351,384** |

PROVINCIAL REVENUE FROM THE PETROLEUM INDUSTRY IN 1983

| | $ |
|---|---|
| Rentals and fees | 40,371,888 |
| Crown reserve dispositions | 26,014,217 |
| Oil royalties collected by Ministry | 89,142,226 |
| Gas royalties collected by B.C. Petroleum Corporation | 102,580,000 |
| **Total** | **258,108,331** |

For comparison, there were 76 wells and 131,134 metres drilled in 1983, a decrease of 30 per cent from the 108 wells and 204,874 metres drilled in 1982. However, in the final quarter of 1983, 64 well authorizations were issued, compared to 25 well authorizations for the same period in 1982. This significant increase was the result of the Desan oil find. This play is not conclusively evaluated and an exploration and development program will continue to establish the area's potential.

The drilling activity carried out for geothermal resources in the Meager Creek area was not continued in 1983.

**Production**

Oil production for 1983 increased slightly from 1982 to 2,078,771.3 $m^3$. At year's end there were 657 producing oil wells, a gain of 24 since the end of 1982.

Non-associated raw gas production was 7,388,360.0 $10^3m^3$, a slight decline from 1982. The number of producing gas wells at year's end was 616 compared to 591 wells at the close of 1982.

**Field Activity**

Activity related to the petroleum industry continued at a low level. Two major projects commenced in the second half of 1983 and continue into 1984: an exploratory drilling program for carbon dioxide in the Flathead area; and the active exploration program in the Desan Lakes area referred to previously, which required construction of a 300-man base camp by Gulf Oil. Without these two projects activity levels would have been below those of 1982.

There were no major drilling problems during 1983, but one of the most productive gas wells in the province, Mobil Sierra a-98-K, had to be prematurely abandoned. This well had been under close surveillance by the District Office and Mobil Oil for some time. It was eventually confirmed that gas leakage was occurring from the well's production tubing into the surrounding casing annulus. It was concluded that the exposure of the production casing to sour gas created a dangerous situation. It was also determined that, due to anticipated down-hole problems, it would be better economically to abandon the well and redrill a new location rather than to attempt repairs. During the abandonment operations, it was determined that numerous sections of the casing had failed due to internal corrosion. These sections

were cement-squeezed and the well was abandoned up to the base of the surface casing. By agreement with the District Office the well head was reinstalled and the well was to be monitored for pressure build-up until the summer of 1984, before final abandonment.

During 1983 there were no major oil spills or environmental incidents. All spills that occurred were of a minor nature confined to the lease area and were readily cleaned up. Several fires occurred during the year at production facilities. A dehydrator fire at Canhunter et al S Julienne b-A82-L totally destroyed the unit, associated piping, and controls.

During March, flaring of solution gas from both the Eagle and Cecil fields was necessary because of excessive pressure in the Westcoast Transmission pipeline. This condition was attributed to faulty inlet scrubbers at the Taylor Gas Plant and resulted in 18 days down time.

A submission was made during July by Northland Utilities (B.C.) Ltd. for approval to construct and operate a gas-treating facility to process raw gas from the Grizzly North field and supply natural gas to the new town of Tumbler Ridge. The District Office staff checked the design and operating sections of the pipeline and made several field inspections while construction was underway. Construction was completed by year's end and gas was delivered to the distribution pipeline.

During the year the majority of the facilities in the Beaver River gas field were abandoned. This had been considered a major gas field, with a substantial gas purchase contract in place. However, the producing capability of the field declined dramatically due to water influx into the reservoir. The seven field wells have been abandoned, site reclamation work is completed and access roads have been reclaimed. This completed Amoco Canada's commitment in the Beaver River field with the exception of the gas plant, pipeline, airstrip, and the access to the Liard River barge site.

**Exploration and Development**

Oil and gas exploration and drilling activity in British Columbia during 1983 was at the lowest level in 27 years. The reasons for this continuing decline were mainly related to poor economic conditions and the lack of demand for natural gas. These factors have resulted in a continuing shift in favor of oil-targeted drilling, which

will provide immediate additional cash flow for companies, and a minor amount of commitment-type drilling in order to protect land tenure requirements. The overall drilling success ratio for the year was 59 per cent, with 45 completions out of the 76 wells drilled.

Exploratory drilling declined by 53 per cent, from 64 wells in 1982 to 30 wells in 1983. This drilling led to 19 successful wells for a success ratio of 63 per cent. The successes were classified as three new pool oil discoveries, nine new pool gas discoveries and seven exploratory outpost completions to established pools. Most of the activity was directed to the Permian and Triassic oil play in the general Fort St. John area with a minor amount of drilling for Debolt gas in the Foothills Belt north of Peace River. The exploratory drilling highlight of the year, however, was the oil discovery in the Desan area, approximately 100 kilometres northeast of Fort Nelson. The discovery well, licenced as a Slave Point gas prospect, recovered clean Mississippian oil from several shallow productive zones. The extent of the discovery will not be known until after the 1984 winter drilling season although a significant new exploration oil play is expected to develop.

Development drilling was essentially the same as the previous year with 46 wells drilled compared to 45 in 1982. Of the 46 wells drilled, 20 were completed for oil and six for gas for an overall success ratio of 57 per cent. Most of the wells drilled, 38 out of the 46, were directed to the development of oil which would qualify for the New Oil Reference Price under the Federal/Provincial Incentive Program Agreement. A few gas wells were drilled for the purpose of retaining leases and one gas well was drilled for deliverability.

Geophysical activity was down slightly with 106 crew weeks compared to 112 in 1982. Seismic activity was general throughout northeast British Columbia with emphasis on the Fort St. John area for oil prospects and the Sikanni Foothills area for natural gas. A limited amount of geophysical activity was also carried out in the Fernie Basin of the southeast sector. In this area, seismic, gravity and geochemistry programs were completed as a preliminary exploration phase leading to additional seismic work in 1984 and eventual exploratory drilling.

**Land Disposition**

During 1983 there were seven dispositions of Crown petroleum, natural gas and geothermal rights. Of this number, five dispositions covered petroleum and natural gas

rights where tender bonuses were required, one disposition was in the form of tendering under a work program bidding system, and the one disposition of geothermal rights was also under the same type of system. The five tender bonus dispositions offered a total of 165 parcels, with 110 being awarded. This covered 141,148 hectares for which tender bonuses amounting to $26,014,217 were received. This bonus total is approximately $10 million greater than that received in 1982, when $16,724,113 was paid for 123 parcels of exploration rights granted covering 166,441 hectares. The additional tender bonus can be attributed to the Desan oil discovery. A comparison with the previous three years' disposition follows:

| Year | Parcels Offered | Parcels Disposed | Total Hectares | Tender Bonus $ | Average Price per Hectare |
|---|---|---|---|---|---|
| 1980 ..... | 735 | 558 | 441,297 | 181,266,804 | 410.76 |
| 1981 ..... | 443 | 316 | 599,208 | 60,776,403 | 101.43 |
| 1982 ..... | 169 | 123 | 166,441 | 16,724,133 | 100.48 |
| 1983 ..... | 165 | 110 | 141,148 | 26,014,217 | 184.30 |

(The 1981 figures include nine parcels covering 283,014 hectares of petroleum and natural gas rights on the Queen Charlotte Islands, which were disposed of for an average price per hectare of $0.18.)

In February, 1983, nine permit parcels of oil and gas rights covering 154,837 hectares in the Fernie Basin of the province were made available under the work program bidding system. Under this method any award is based on what is considered to be the best work program consisting of geological or geophysical exploration and drilling. Chevron Canada Resources Ltd. was awarded the nine permit parcels by virtue of their program in which they committed to spend $7,150,000 over a four-year period. At the end of the fourth year the company may retain the exploration permits for a further two years provided they commit to the drilling of an additional exploratory well. This may also be repeated in order to hold the permits for their seventh and eighth years, at which time the company would be able to select leases.

The first disposition of geothermal rights held in British Columbia, and also the first to be held in Canada, was advertised and awarded in June, 1983. The disposition offered six geothermal permit parcels covering 49,716 hectares in the Mt. Cayley area, located approximately 100 kilometres north of Vancouver. A work program submitted by O'Brien Energy and Resources Ltd. was accepted for one of the permits available. The commitment from O'Brien is to undertake yearly obligations over a five-year period which could result in an expenditure of $4,249,720 if all obligations are exercised. The other five geothermal permit parcels were not awarded.

**Planning for Renewed Offshore Exploration**

The petroleum industry has indicated an interest in renewing offshore exploration activity off British Columbia's coast. Although questions of ownership and jurisdiction over the area have not been settled, the province and the federal government reached an agreement during the year to cooperate in a joint review of the environmental and directly related socio-economic implications of offshore petroleum exploration activities. The area covered by the agreement extends seaward of the low water mark to the limit of the continental rise between 50°40'N and 54°40'N.

Initial Environmental Evaluations were prepared and submitted to both governments by Chevron Canada Resources Ltd. and Petro-Canada Inc. for use in the public review.

# ENERGY RESOURCES DIVISION

The mandate of the ministry is to ensure energy security for British Columbians. That mandate is pursued by the Energy Resources Division which advises on appropriate policies and programs to achieve the goal of energy security in relation to other provincial goals for economic development and environmental integrity.

# Policy Development Branch

The Policy Development Branch is responsible for developing and recommending short- and long-term energy policy strategies for the province. Specific policy work in 1983 centred on:

- developing a new natural gas marketing and royalty system;
- capitalizing on the opportunities for industrial development based on the province's extensive natural gas resource and electric power surplus;
- expanding export markets for natural gas and electricity; and
- extending natural gas service within the province.

In 1982, the minister appointed Dr. George W. Govier as chairman of a study group to assess and make recommendations on factors relating to natural gas marketing and measures to stimulate exploration and development. In September, 1983, the government released the study group's report, *A Report on the Marketing of British Columbia Natural Gas*, together with a *Decisions and Comments* paper which summarized the government's decisions on the report's recommendations. The government reserved decision on certain recommendations pending receipt of written comments and proposals from interested parties.

The decisions which the government announced were designed to:

- promote innovative and aggressive marketing which would eventually result in expanded sales of British Columbia natural gas;
- stimulate natural gas exploration activity with higher, more predictable producer netbacks;
- provide a rational provincial pricing system by linking the wholesale price of natural gas to the price of crude oil landed in Vancouver; and
- levy an explicit royalty on natural gas in place of the prevailing implicit royalty regime.

In conjunction with the September, 1983, release of the marketing report, the government announced that Dome Petroleum Ltd., principal proponent of the Western LNG Project, would be authorized to enter into direct negotiations with producers for the purchase of natural gas, including pricing arrangements. In December, 1983, the minister announced British Columbia's commitment to increase the province's share of natural gas supply to the LNG project from 25 per cent to 50 per cent, with the understanding that incremental natural gas volumes would be off-peak gas currently under contract to the B.C. Petroleum Corporation. The government also announced that for natural gas used in the project, royalty would be based on a minimum deemed price.

Under the Gas Extension Assistance Program (GEAP), the government provided capital assistance of $370,000 to extend natural gas service in the Peace River region.

In 1983 the branch completed an analysis of the electricity sector. Subsequently, the government announced several new policy initiatives including:

- approval in principle of long-term firm and interruptible electricity exports to the U.S. from existing facilities;
- temporary discount electricity prices for incremental consumption by existing industrial customers;
- encouragement of the private development of remote hydro-electric sites not connected to the B.C. Hydro grid; and
- a delay in the implementation of B.C. Hydro's target interest coverage ratio of 1.3:1 from 1983/84 to 1990/91, in order to avoid large rate increases.

At year's end, B.C. Hydro was involved in negotiations with potential United States customers and had made application to the Minister of Energy, Mines and Petroleum Resources and to the National Energy Board for the first major removal of surplus power under this new export policy.

The branch maintained extensive liaison with federal and provincial governments and agencies. In 1983, the branch was involved with the federal/provincial task force which examined pricing issues for natural gas exports. The branch, in conjunction with the Ministry of Attorney

General, represented the province on several National Energy Board regulatory hearings on tariffs for Westcoast Transmission Ltd. and Trans Mountain Pipe Line Ltd. The branch also continued its liaison with the federal government and other provinces relating to the design and implementation of a contingency response plan in the event of a possible international oil crisis.

# Project Analysis Branch

The Project Analysis Branch coordinates reviews of proposals for the development, use, and removal of British Columbia's energy resources. Under the *Utilities Commission Act* of 1980, large-scale energy generation facilities, transmission lines, pipelines and transshipment or storage facilities as well as energy removals from the province must be certificated as being in the public interest. This is done through application to the Minister of Energy, Mines and Petroleum Resources.

Upon receipt of applications, an integrated assessment of key energy, economic, environmental and social implications of a proposed project are undertaken. The branch is responsible for coordinating and acting as a 'single window' for this project assessment process.

Reviews of applications are conducted on an inter-ministry basis; the result is coordinated advice on the disposition of applications. Under the Act, ministers may refer projects to public hearings, or to routine utility regulation, or make direct decisions which may include conditions on an Energy Project Certificate. The minister, with the concurrence of the Minister of Environment, makes final determinations on issuance of Energy Project Certificates. For applications referred to public hearings, cabinet determines the issuance of certificates and associated conditions.

In May, 1983, the B.C. Utilities Commission's report on B.C. Hydro's 'Site C' hydro-electric proposal on the Peace River was received. It was the first major project referred by government for public hearing. In November, the government announced that the project, while technically feasible, would not likely be required until 1990 at the earliest. Hence the application for an Energy Project Certificate was rejected. The government also announced that by the 1990s, when demand warrants, it may be preferable to consider smaller hydro-electric projects, such as Keenleyside or Murphy Creek on the Columbia River.

Government simultaneously announced that long-term interruptible and firm sales of surplus electricity to the United States would be part of a new provincial electrical strategy. At year's end, B.C. Hydro had made application to

the minister for the first major removal of surplus power under this new export policy. Government also advised that it would encourage private development of small and medium-sized hydro-electric sites in remote areas not connected to B.C. Hydro's grid. Qualifying proposals would be subject to the energy project review process.

Review continued on the proposal by Dome Petroleum Ltd./NIC Resources Inc. to export liquefied natural gas to Japan. In the spring of 1983 the government, after independent analysis, confirmed Dome's choice of Port Simpson as the site for the liquefaction plant and terminal facilities. With the Ministry of Attorney General, the branch coordinated the British Columbia government's participation at the National Energy Board's project hearings. Work continued on other related matters, such as initial review of the application for the transmission pipeline required to serve the LNG project, and underground storage facilities at gas fields in northeastern British Columbia.

The branch also continued to coordinate review of the Aluminum Company of Canada's proposal to increase electrical generating capacity at Kemano and to build a new aluminum smelting capacity in northwestern British Columbia. A Preliminary Planning Report on the project was submitted by Alcan and distributed to appropriate ministries for review under the energy project review process. Policy issues presented by the project were under review at year end.

Other projects reviewed included feasibility studies by B.C. Hydro on various new electrical generation proposals, including generation projects on the Columbia, Homathko, Stikine, Iskut, and Liard Rivers. Towards the end of 1983, Homathko and the northern projects were officially deferred by B.C. Hydro in response to lower anticipated growth in power demands. Review of the Keenleyside and Murphy Creek hydro-electric proposals on the Columbia River, including their associated transmission lines, continued. Northern electrical transmission proposals were officially deferred by B.C. Hydro but study and initial review continued on 'system strengthening' projects such as the Williston-Glennanan-Telkwa and Skeena-Rupert projects. Construction monitoring of the Kelly Lake-Nicola transmission line was also carried out during 1983.

Staff worked with other division branches in developing terms of reference and associated documentation for the B.C. Utilities Commission public hearing on applications to construct and operate gas transmission facilities to and on Vancouver Island.

The branch continued to represent the division in various intra- and inter-ministry liaison activities relating to land and water use and impact management issues. An information paper on ministry land use policy was completed in 1983 for publication in 1984.

# Forecasts and Special Projects Branch

During 1983, the Forecasts and Special Projects Branch undertook further refinements to its provincial energy demand forecasting and planning model and prepared selected forecasts for internal purposes, such as: a forecast of electricity supply/demand balances used in the government's review of the report by the B.C. Utilities Commission on the Site C electricity generation project; and selected volume and price forecasts for oil and natural gas revenue forecasts required by the Ministry of Finance.

As input to policy formulation on natural gas export matters, the branch commissioned studies on future prospects for gas exports to the United States and the role of pricing in those markets, and it participated in the federal/provincial advisory committee on gas export pricing. In relation to proposed exports of LNG, the branch redetermined the projected natural gas surplus in light of revised forecasts of exports and provincial requirements and supply capability. The revised estimate of the natural gas surplus was higher than the estimate adopted by the ministry in 1982, and it permitted the government to increase the allocation of natural gas to the proposed Western LNG facility from 25 to 50 per cent of the plant's requirements.

In 1983 the branch spearheaded the division's work on the Vancouver Island pipeline project. *Natural Gas Supply to Vancouver Island: Technical Report*, a study of the economic, financial, and technical feasibility of the project, was published in April, 1983. The branch thereafter was involved in a call for applications to transmit natural gas by pipeline to and on Vancouver Island, in the preparation of terms of reference for public hearings on the project, and in the referral of applications to the Utilities Commission in July, 1983. The branch was also extensively involved in detailed discussions with Energy, Mines and Resources Canada respecting the economic costs and benefits of the project.

# Conservation and Renewable Energy Branch

For the past five years, the Conservation and Renewable Energy Branch has provided financial support for energy conservation projects throughout British Columbia, the objectives of which were to:

- develop and demonstrate promising new technologies which, when widely adopted, will exploit renewable resources, conserve energy and/or use energy more efficiently;
- foster public awareness of the potential of renewable energy and conservation technologies;
- provide opportunities for the commercial application of the technologies in British Columbia; and
- create economic benefits for manufacturing, industry, and commerce, including employment in new or existing energy-related industries.

To achieve these objectives, solicited and unsolicited proposals involving demonstrations, analyses, and resource assessments for energy projects were accepted and carried out in the following areas:

| Type of Energy Project | Number |
|---|---|
| Solar | 97 |
| Wind | 3 |
| Small hydro | 5 |
| Geothermal | 2 |
| Energy from wood waste | 4 |
| Energy from municipal garbage | 1 |
| District heating | 2 |
| Cogeneration | 3 |
| Conservation in buildings | 10 |
| Alternative transport fuels | 3 |
| Railway electrification | 1 |

The branch also offered a free mobile energy auditing service to the industrial and commercial sectors designed to assist in energy cost savings.

The provincial government concluded during 1983 that branch objectives had been achieved and the private sector had been sufficiently stimulated by the funding programs to carry on without further government support. It was felt that private initiative would continue to give rise to the increasing use of renewable energy resources and the further adoption of energy conservation measures. Financial support for external projects as well as the mobile energy auditing program ends in 1984.

# MINERAL RESOURCES DIVISION

The Mineral Resources Division oversees the operation of British Columbia's extensive mining industry and facilitates the orderly development of mineral, coal, and aggregate resources in the province. This responsibility includes: providing technical safety inspection at minesites, advising the minister and government agencies on the economic impact of mineral taxation and regulatory policies, aiding the mineral industries with geological surveys and an appropriate data base, protecting mineral lands from alienation, and administering tenure on mineral lands.

# Inspection and Engineering Branch

The Inspection and Engineering Branch has the responsibility to ensure that the maximum possible recovery of natural resources from mining operations is achieved while keeping personal injury and environmental disturbance to a minimum. To do this, the branch maintains a network of district offices staffed by experienced professional personnel and supported by specialist engineers based in Victoria.

On a regular basis, staff members conduct safety and engineering inspections at all metal mines, coal mines, sand and gravel pits, placer mines and quarries throughout the province.

The branch further ensures that every employee working in an underground or open-pit operation is under the supervision of a person holding an appropriate supervisor's certification. Examinations are administered to ensure that supervisory candidates meet the required standards of training and education. Certificates for miners, coal miners and blasters are also issued from the district offices.

**Mechanical/Electrical Section**

Trained engineers and technicians are required to ensure that equipment used in the mining industry is safe and conforms to ministry standards. The Mechanical/ Electrical Section is responsible for mechanical and electrical approvals, and for such inspections as are necessary for the safe operation of equipment. Staff members make additional detailed engineering evaluations and inspections of all mobile equipment over 50 tonnes and all other equipment which has innovative or special design features. Such equipment would include: large haul trucks, loaders, shovels, drills and cranes, as well as specialized flameproofed equipment for use at underground coal mines.

Staff members work in close cooperation with industry, manufacturers, engineers and contractors. Members have spent considerable time reviewing design drawings, manufacturing specifications and final installation plans for several mine hoists. They are also in attendance at the

commissioning of these installations which involve both drum and friction-type hoists.

The designs of several diesel-powered vehicles have undergone intensive engineering reviews and tests prior to their acceptance for use in underground coal mines within recent years. In one particular case, some of the most advanced engineering techniques available were incorporated into the design of such a vehicle by the manufacturer after receiving input from both the mine purchasing the vehicle and from members of the section. Staff engineers and technicians closely monitored this vehicle's performance in order to ensure its subsequent safe operation in the underground coal mine environment. Several additional models of this vehicle were later put into operation following ministry approval of the original unit.

Manufacturers continued to introduce both new and adapted versions of large haul trucks. All new models of more than 50 tonnes gross vehicle weight are subject to rigorous engineering reviews before they can qualify for use at mining operations. A recent trend has been to all-hydraulic braking, rather than the air/hydraulic braking previously used extensively on these vehicles. This has required the section to ensure that such designs would not compromise other dependent systems essential to the overall safe operation of the vehicle. Physical testing of these large vehicles is conducted under mine site conditions, and braking performances during high-speed downhill tests are closely monitored and evaluated by staff members.

The section has continued to represent the ministry on the Mobile Equipment Committee of British Columbia. This provincial committee attempts to provide both manufacturers and purchasers of mobile equipment with an accelerated means of gaining approval for equipment, irrespective of which authority will regulate its future use.

Section members have also continued to participate in the work of the Canadian Standards Association, with representation on technical committees preparing standards for the use of diesel-powered equipment in underground coal mines, for the use of fire-resistant fluids in underground mines, and for the use of electricity in mines.

**Geotechnical Section**

Geotechnical engineering assignments performed by the Geotechnical Section include the inspection and assessment of stability of tailings impoundments and waste dumps at mines.

The number of active tailings impoundments decreased somewhat in 1983 due to prolonged cessations of operations and outright closures. One active mine, Ladner Creek, was temporarily forced to suspend its operations in the spring because the tailings impoundment did not have sufficient capacity to store both tailings and natural runoff, but the storage capacity was increased later in the year to enable operations to continue in an orderly manner. Apart from a number of impoundments that were approaching their storage limit, no other problems related to tailings impoundments were reported.

Some large failures of waste rock dumps were reported during the year in the vicinity of Elkford. None of these occurrences resulted in appreciable damage.

*Guidelines for the Design, Construction, Operation, and Abandonment of Tailings Impoundments* was revised in 1983.

**Reclamation Section**

Lands used for mining, mine waste disposal or exploration in British Columbia are required to be restored to a useful purpose compatible with appropriate land use values. The Reclamation Section is responsible for ensuring that any lands disturbed by mining since 1969 be reclaimed and revegetated. The ministry requires that prior to any surface disturbance at a worksite, a reclamation permit be issued and a security deposit be retained until a reclamation program is adequately completed.

A staff of six reclamation inspectors and technicians ensure that reclamation is carried out by making periodic field inspections, through administering all reclamation permits and through detailed technical review of proposed reclamation programs.

Reclamation staff work in close cooperation with members of industry and universities through the Technical and Research Committee on Reclamation. This committee has been active in supporting reclamation research and information exchange to ensure that technology advances in reclamation are disseminated rapidly throughout the mining industry.

The annual B.C. Mine Reclamation Symposium was again held in 1983. One hundred and fifty delegates heard presentations on wide-ranging reclamation topics. During this symposium, the B.C. Mine Reclamation Award was presented to the environmental services of B.C. Coal. Citations were presented to Crows Nest Resources for coal

mine reclamation, to Fording Coal Ltd. for exploration reclamation and to Craigmont Mines Ltd. for metal mines reclamation. A special citation was presented to Dr. J. C. Errington.

**Mine Rescue and First Aid Section**

The ministry's mandate includes the training of mining personnel in mine rescue and first aid. Training courses available through this ministry are:

Survival Mine Rescue
Underground Mine Rescue
Gravel Pit Mine Rescue
Surface Mine Rescue
Safety-Oriented First Aid
Standard First Aid
Industrial First Aid

The courses are conducted or examined by ministry training coordinators in mine rescue stations located at Nanaimo, Smithers, Kamloops, Prince George, Nelson and Fernie.

These stations are stocked with equipment and supplies to carry out the training. They are further equipped with sufficient oxygen and/or air-type breathing apparatus to sustain one surface and two underground mine rescue teams, consisting of six persons per team. Additional auxiliary equipment (first aid supplies, ropes, stretchers, self-rescuers, rescue drums, etc.) is also on hand. The mine rescue coordinators, their equipment and vehicles are kept in constant readiness in the event of a mine emergency.

Mine rescue teams trained in British Columbia have assisted in mine disasters outside the province in the past and have also competed in Canadian and international mine rescue competitions. Mine rescue training in British Columbia has proved to be superior on most counts to any other training of this nature in North America.

The ministry provides support for mine safety associations active in the province which were organized to help promote mine rescue and first aid. Association membership includes representatives from the Mine Rescue and First Aid Section, the Workers' Compensation Board, the St. John Ambulance Association, suppliers and industry. The associations sponsor safety competitions under simulated disaster conditions, which serve to extend the members' skills in protecting lives and property through practical experience.

District mine rescue coordinators make regular field trips to mining operations to inspect mine rescue and first aid equipment and supplies.

**Environmental Control Section**

The Environmental Control Section is responsible for testing and maintaining safe atmospheric working conditions at mining operations. Staff members inspect and monitor dust, other airborne contaminants, ventilation, noise and radiation levels in mines. In addition, spot checks are made to determine levels of illumination at mine sites.

During 1983, the section monitored and inspected most mining operations on a regular basis throughout the province. In instances of unsatisfactory conditions, the ministry requested and received mine management cooperation in rectifying unsafe conditions.

Audiometric testing of mine employees for noise-induced hearing loss was continued regularly at most mining operations.

**Coal Section**

During 1983, the section staff was comprised of a Senior Inspector of Mines (Coal), three District Inspectors and two Inspectors of Mines.

The inspector's responsibilities include:

- enforcing relevant sections of the *Coal Act*, *Mines Act* and Coal Mines Regulation;
- assisting in the safe operation of exploration, development and eventual coal mining operations;
- routine safety inspections of mines and properties in the districts on a monthly basis or as circumstances require;
- investigating fatal and serious accidents and dangerous or unusual occurrences reported by the mines;
- inspections of old mine workings to ensure the safety of the public against inadvertant access; and
- strict control and use of explosives at mines as required by both federal and provincial regulations.

All submissions to the Coal Guidelines Steering Committee involving major mining projects are reviewed by this section before advancing to the permitting stage.

The Coal Section examines proposed systems of mining and changes to existing methods of work for underground and open-pit operations before approval by the Chief Inspector.

A three-member Board of Examiners, consisting of the Chief Inspector as chairman and two other inspectors, is responsible for the examination and issuance of statutory certificates. The Senior Inspector of Mines and a District Inspector are appointed by the minister under the *Mines Act* to be members of this board.

**Mining and Petroleum Roads Program**

The Mining and Petroleum Roads Program provides funding under the *Ministry of Energy, Mines and Petroleum Resources Act* to construct and maintain various roads. This program encourages mineral and fossil fuel resource development by providing better access to areas of exploration activity.

Sixty kilometres of all-weather road leading to the Sierra-Yoyo gas-producing area east of Fort Nelson was constructed in 1980. From 1980 to 1982, approximately $352,000 was spent for annual general road maintenance. In 1983, an additional $66,000 was required to provide fill for poor road sections, grading, ditching and culvert repair.

Also during 1983, $218,625 was spent to maintain and upgrade the Omineca Road from the Nation River to Moose Valley, a distance of 335 kilometres. Work included construction of a bridge north of Johanson Lake, gravelling, grading, ditching and limited maintenance of 66 kilometres of the Takla Spur access.

The shared-cost road grant program remained inactive in 1983 due to budgetary restrictions.

# Geological Branch

The solid mineral industries, metallic, non-metallic and coal, need to engage continuously in exploration to replace the resources currently being mined. The role of the Geological Branch is to facilitate this search.

During 1983, Geological Branch staff were active in professional activities related to their work, including: organizing and attending scientific meetings, field visits, executive activities in societies, membership on local and national committees, and reviewing articles for various journals.

Branch personnel played major roles in organizing two important meetings.

*Victoria '83*, the national joint meeting of the Geological Association of Canada (GAC), Mineralogical Association of Canada (MAC) and Canadian Geophysical Union (CGU), was held at the University of Victoria in May. The meeting was attended by more than 1,200 registered delegates from Canada and abroad. Staff also organized GAC and MAC short courses that preceded the meeting, co-led field trips with industry, other government or university geologists, and prepared guidebooks for the field trips.

The Canadian Institute of Mining and Metallurgy (CIM) Annual District 6 Meeting in Smithers was also organized by ministry personnel. More than 700 delegates attended.

In addition, technical presentations were made by the ministry's project geologists at many meetings during the year. These presentations enabled the geologists to disseminate results of their studies to the exploration fraternity, less formally and with an opportunity for discussion.

A series of publications and maps presents the work of the Geological Branch to industry and the public. Yearly publications include *Geological Fieldwork* and *Exploration in British Columbia*. Mapping issued by the branch includes: Regional Geochemical and Aeromagnetic Surveys, Mineral Deposit/Land Use Maps (Mineral Potential), Mineral Inventory Maps, Assessment Report Index maps, and a series of Preliminary Maps. Three computer-based files are also

available: MINFILE -- a mineral deposit inventory, COALFILE -- comprehensive coal exploration and analytical data, and Assessment Report Index -- a bibliography.

The branch presents many of its geological studies as ministry papers or bulletins, or in articles published in scientific and technical journals, and maintains a substantial field and laboratory program.

**Geoscience Projects Section**

Geoscientific mapping, surveys, and related research are provided by the Geoscience Projects Section in order to stimulate and facilitate effective exploration and production of provincial mineral and coal resources. In the course of its work, the section accumulates geological expertise useful in advising government agencies and the mining industry. The exploration industry has a particularly critical need for the products of field mapping and related research produced by the section. Regional geochemical reconnaissance surveys, jointly funded by the federal and provincial governments and conducted by the section with the help of the Analytical Laboratory, have been effective for both exploration and environmental baseline studies.

Major projects and commodities studied by the section during 1983 include:

- Salmon River area, near Stewart (Au, Ag, Cu);
- Mosquito Creek area, near Wells (Au, Ag);
- Purcell Supergroup in southeastern British Columbia (Pb, Zn);
- Shuswap deposits (Pb, Zn, Cu);
- Greenwood area (Cu, Au);
- Tertiary Intermontane basins (Au, Ag, coal, industrial minerals);
- Akie River shale-hosted deposits, northwest British Columbia (Ag, Pb, Zn);
- Midway area, northern British Columbia (Ag, Pb, Zn);
- Windy-Craggy area (Cu, Mo, Au);
- Babine Range study (massive sulphides);
- Toodoggone precious metal deposits (Au, Ag);
- Cassiar map-area (Au, Ag, Cu, Mo);
- Coquihalla project, near Hope (Au, Ag);
- Harrison Lake gold belt (Au, Ag);
- Tillicum Mountain gold (Au, Ag);

- Adams Plateau (massive sulphides, Au);
- Coal quality analysis, detailed property analysis, correlation program, Northeast Coalfield (coal);
- Structural analysis, South Dominion Coal Block (coal);
- Bowser Basin coal potential analysis including Telkwa/Mount Klappan (coal).

Geological studies, conducted principally by the section's project geologists, were often augmented with work by the district geologists and laboratory scientists of other branch sections. Reports on projects undertaken and properties examined by the geologists are reported yearly in *Geological Fieldwork*.

After a year's absence the Regional Geochemical Stream Silt and Water Survey Program was reactivated in 1983. Federal involvement was also reintroduced. The two governments cooperated without formal exchange of funds. British Columbia supplied management and supervision of the field component for both map sheets sampled, and funds for the work in the Hazelton sheet (NTS 93M). The Geological Survey of Canada funded sampling in the Manson River sheet (NTS 93N) and paid the sample preparation, analytical, and data processing costs for both areas.

**Applied Programs Section**

The Applied Programs Section is responsible for monitoring and assisting the field activities of the mineral exploration industry. Geological information on the intensity and distribution of mineral exploration is provided by the section to government and industry for more orderly resource management. The section also offers technical aid and training assistance to prospectors, exploration personnel, and developers.

Applied Programs are carried out by district geologists operating from six district offices and from headquarters in Victoria. Their responsibilities include on-site examinations of mineral properties to assess mineral activities and to aid in making effective land use decisions. District geologists are also engaged in field research and mapping, and represent the ministry on regional resource management committees.

Applied Programs research during 1983 has included:

- field programs on the proposed Wokkpash Park and Brent Mountain recreation area;
- a study of precious metal deposits in northern British Columbia;

- mapping of Butler Ridge area coal measures near Chetwynd;
- ongoing studies of the Elk Valley Coalfield.

Other geological fieldwork studies by district geologists are described in *Geological Fieldwork*.

The section devotes a considerable amount of staff time to training prospectors. In 1983, eight basic prospecting courses were conducted at locations throughout the province. A two-week-long advanced mineral exploration course is held annually in the spring. The section is also responsible for the administration of the *Mineral Prospectors Act* and the related Prospectors' Grant Program. This funding has been responsible for the discovery of several substantial mineral deposits and the resulting exploration and economic activity. In 1983, funding of $100,000 for this program resulted in the support of 54 grantees who actively explored for minerals around the province.

**Resource Data and Analysis Section**

The Resource Data and Analysis Section compiles and interprets exploration and development data gathered on coal and mineral resources. This data provides an important source of information that allows government and industry to increase exploration efficiency. The section also helps ensure that mineral lands are properly managed and makes assessments of mineral potential on mineral-bearing lands before various land use designations are approved. Most of the mineral exploration industry information collected by the section is made available to the public after a one-year confidential period. For coal, most exploration data is confidential for three years.

Major files compiled by the section include:

- Mineral Assessment Reports -- over 11,000 microfilmed reports available at reader/printers in Vancouver and Victoria. Original reports are on file in Victoria and in the appropriate district geologist offices.
- Mineral Assessment Report Index -- a computerized numerical index and alphabetical property index that is updated monthly, and a map series that is updated semi-annually.
- MINFILE -- a computer-based mineral deposit file which is a companion to the Mineral Inventory Map series. It includes summary description and bibliography on more than 8,700 mineral sites and statistical data on mineral production and reserves. This file is updated annually.

- Property Files -- open files containing published and unpublished reports, as well as historical maps on producers and prospects.

- Coal Assessment Reports -- over 500 reports on coal exploration on file. Non-confidential files are available in Victoria and the appropriate district geologist office.

- COALFILE -- a comprehensive computerized coal exploration analysis data file, compiled and updated annually from assessment reports submitted on coal licences.

- Mineral Deposit/Land Use Map Series -- a series of interpretive mineral potential maps compiled for the province.

- Industrial Minerals Inventory File -- location, geological setting, size, quality, and industrial applications for deposits of a wide range of commodities, available for inspection in Victoria.

- Index to Bedrock Geological Mapping -- a list by NTS, area, author, and publication is available.

The section produces an annual publication entitled *Exploration in British Columbia* and a map of Mines and Significant Mineral and Coal Deposits of British Columbia (scale 1:2,000,000).

Section staff produce map compilations and mineral potential evaluations for land use assessments. Site investigations for these assessments are made by section and district geologists. Section staff are also involved in land use planning programs such as those for South Moresby Island and the Slocan Valley.

Field-oriented studies related to industrial minerals and structural materials are also handled by this section.

During the 1983 fieldwork season, property examinations were carried out on building stone, barite, and magnesite deposits. Progress on aggregate, barite, and silica projects was minimal. A study of rutile in mine tailings proceeded by collecting and analysing samples from mines that were active during 1982/83.

The Coal Resources Subsection continued to participate in a Canada/British Columbia Coal Data Program. Under this program British Columbia compiles coal exploration and analysis data for coal properties while Canada, through the Institute of Sedimentary and Petroleum Geology, compiles the geological data for coal properties. The data is exchanged and both parties are able to make coal reserve and resource estimates for their respective agencies.

**Analytical Laboratory**

The Analytical Laboratory offers a complete range of geochemical analyses in support of the projects conducted by the branch's district and project geologists. Laboratory staff provide analytical support for the Prospectors' Assistance Program and perform a limited number of free analyses for holders of a valid Free Miner's Licence. Some custom laboratory work is performed for various other government agencies. The laboratory is further responsible for certifying assayers in the province, and through this program controls the quality of work done by commercial mining assay laboratories. Semi-annual Certification in Assaying examinations were held by the laboratory during 1983.

The Chief Analyst assists in the administration of the regional geochemical survey program.

The facilities of the laboratory include: comminution and mineral separation equipment, X-ray fluorescence and atomic absorption equipment, gamma ray and emission spectrometric instruments, and an X-ray diffractometer. The laboratory is also capable of performing traditional fire assay and wet chemical analyses.

A significant amount of method development and research was conducted by the laboratory in 1983. Many of these studies were carried out in cooperation with the Geoscience Projects Section and numerous other government agencies. The studies included:

- titanium in mine tailings;
- computerization of analytical techniques;
- analysis of geochemical standards;
- mineralogy of the Tillicum Gold prospect;
- follow-up analysis of regional geochemical survey data;
- participation in Canada/Japan coal liquefaction studies.

# Mineral Policy and Evaluation Branch

The former Mineral Economics Branch was reorganized in early 1983 to encompass the mining project review function from the Inspection and Engineering Branch. The branch was renamed Mineral Policy and Evaluation Branch and was restructured into four groups. The Financial and Economic Analysis Group, Mineral Statistics Group and Mineral Policy Group perform the functions of the previous Mineral Economics Branch, i.e. the provision of economic, financial and statistical analyses pertaining to provincial mineral sector policy, legislation and planning, and the collection, maintenance and dissemination of comprehensive statistical data in support of ministry resource management responsibilities. The Project Evaluation Group provides coordination services and administrative support for the province's two main review procedures for new mines: the Guidelines for Coal Development and the Procedures for Obtaining Approval of Metal Mine Development.

During 1983, the Financial and Economic Analysis Group carried out numerous research studies and evaluations of new coal and metal mining projects. Major projects during the year included:

- an internal report, *Mineral Sector Current Conditions and Outlook*, including price and production forecasts to 1986;
- a report on the improvements to MINSIM, the ministry's computerized metal mining financial simulation model: *MINSIM CASH Functions - a Programmer's Guide*;
- financial analyses of several proposed coal projects;
- update of the report *Taxation of Coal Mining Projects in British Columbia*;
- financial analysis of the Northwest B.C. mining projects for inclusion in *Northwest Economic Development Studies*, a series of detailed reports published by the Cabinet Committee on Economic Development;
- information for several special media reports on the Canadian mining industry;
- preliminary studies for the *Long Term Outlook for the B.C. Mineral Sector* project.

The Mineral Policy Group continued to provide analytical support, investigation and policy advice on a wide range of topics on current policy, legislative and regulatory matters concerning the province's mineral sector. During 1983, these included:

- renewal of an agreement with Teck Corp. under the *Copper Smelting and Refining Incentives Act*;
- various cabinet submissions on such matters as road maintenance grants and the amendment to the *Court Enforcement Act* with regard to product liability claims;
- a study on ferrosilicon metal production potential in B.C.;
- briefings on major mining-related subjects for the Mines Ministers' Conference and other major conferences;
- reports on northwest economic development with specific emphasis on mineral development;
- a status report on data collection and survey activities of the Mineral Resources Division;
- background papers on the Dominion Coal Blocks and the Federal-Provincial Mineral Subsidiary Agreement.

Publication of the *B.C. Mineral Quarterly*, which contains key current and forecast indicators of performance of the mining industry, continued in 1983 and was widely distributed.

The branch continued to provide divisional coordination for the Mineral Resources Division during 1983 and assisted with budget coordination, definition of a new management reporting system and various special projects.

During 1983 the Mineral Statistics Group carried out its regular statistical surveys, which include the collection, editing, compilation and dissemination of all mineral production data for the province on a monthly and annual basis. Much of the data generated by the group is shared with Statistics Canada and with Energy, Mines and Resources Canada. Staff in the group participate regularly in joint consultative efforts with other governments to streamline the data collection process and improve the accuracy and validity of mineral statistics. The monthly metal mines surveys are being computerized back to 1981 and this will lead to greatly increased accuracy and timeliness of statistical reports.

During the year, the Project Evaluation Group continued the administration of the two mining project review procedures to facilitate publicly acceptable mine developments in British Columbia. Through the review processes, potential environmental, social and economic impacts of mining are identified and plans are made for adequate impact management.

In mid-1983, the Project Evaluation Group initiated a comprehensive evaluation of the two review processes. By the end of the year, it had identified options for significant streamlining of the province's review and approvals procedures for mining projects. Considerable further effort will be directed towards streamlining in 1984.

During 1983, approvals-in-principle were granted for: extensions of three existing coal mines (Balmer, Fording, Byron Creek); two small new coal operations (Countryside, Wolf Mountain); two medium-sized new coal projects (Willow Creek, Quinsam); one large extension at an existing metal mine (Westmin); and four small new metal mines (Blackdome gold/silver, Bralorne gold, Banbury gold, Rossland gold/copper/molybdenum). Project Evaluation staff also coordinated the preliminary environmental review of various mine-related development options in northwestern British Columbia, culminating in the publication of an environmental overview report in late 1983.

# Mineral Titles Branch

The Mineral Titles Branch, under the direction of the Chief Gold Commissioner, is reponsible for administration of provincial laws and regulations relating to acquisition and maintenance of tenure for minerals and coal. Gold Commissioners and sub-recorders are appointed for 24 mining divisions throughout the province. Stakings and all work on mineral claims and placer leases must be recorded at the Gold Commissioner's office in the division where the claim or lease is located.

Copies of recorded mineral claims are forwarded daily to the Chief Gold Commissioner's office in Victoria. Information concerning claims and leases can be obtained from this office, from the division where the property is located, or from the Mineral Titles office in Vancouver which maintains a duplicate record system.

Maps and records showing approximate positions of mineral claims may be viewed by the public at the Gold Commissioner's or ministry offices. Prints of titles maps for the entire province may be obtained in Victoria and Vancouver.

In 1983, the branch received 1,787 applications for placer leases in designated placer areas. There were 30 requests for designations of additional placer mining areas during this period.

The staking of mineral claims and placer lease applications may be checked for compliance with the Acts by claims inspectors stationed in Kamloops, Smithers, Vancouver and Nelson. Inspectors investigate disputes and possible misuse of claims and leases. Twenty-nine mineral claims were cancelled in 1983 as a result of complaints made under Section 50 of the *Mineral Act*.

Also in the branch, the Coal Administrator is responsible for reviewing applications for coal licences and leases and maintaining and recording coal titles records.

The branch is currently embarked on a pilot project to computerize the Victoria and Liard Mining Divisions. Computerization of Mineral Title Reference Maps is also under way. These projects are scheduled to continue until the provincial Gold Commissioners' network is computerized in 1986.

# PETROLEUM RESOURCES DIVISION

The Petroleum Resources Division is responsible for all matters related to Crown-owned petroleum and natural gas rights in British Columbia. The division supervises the disposition of these rights and regulates all exploration, development and production operations of the oil and gas industry. Geothermal resources are also regulated by this division.

# Engineering and Operations Branch

The Engineering and Operations Branch is responsible for the operational activities of the petroleum industry.

The branch continued to deal with a heavy workload in 1983. In addition to their normal regulatory work, branch staff carried out a number of essential projects, discussed in the section reports which follow. The most important of these were the development of implementation procedures arising from the Natural Gas Marketing Study, and the updating of regulations on control of air pollution and disposal of wastes in field operations.

**Development Engineering Section**

The Development Engineering Section is responsible for the administration of all matters related to the location, drilling, completion, and abandonment of petroleum and geothermal wells. This involves the assurance that operators of all wells located, drilled, and produced conform with regulations and submit the required applications, reports, and information to the division.

Approval of well authorizations to drill proposed well locations is granted by the section after review and reference to the Titles and Geological Branches. There were 110 well authorizations issued for petroleum drilling in 1983, 34 per cent more than during 1982, principally due to the flurry of applications processed at year's end. Throughout the life of a well the status, well name or classification may be changed as circumstances require. During the year status was changed on 89 occasions, well names on 124, and well classifications on eight.

Each quarter, a field and pool description is published and circulated to the industry based upon the geological interpretation made by division staff. All drilling and service rigs operating in the province must have a valid Rig Licence. Ninety-six were renewed while one new one was issued during the year.

In addition to comprehensive well data records, all geological and geophysical reports submitted for work credits, as well as the division correspondence files of the

three branches, are maintained by the Development Engineering Section. The microfiche library containing British Columbia well data, which is produced by a commercial service company, continued to be used by division staff. This is supplemented by a set of all logs taken from British Columbia wells and from important nearby wells.

Greater use of the section's computer installation was made during 1983 and the transfer of data to the computer continued. Implementation of the Govier Study recommendations was initiated for use on the computer during the coming year. This study presents a new marketing and royalty system for natural gas in the province. The royalty would be based on three factors in addition to the gas volume produced, i.e. age since first production, depth, and ease of accessibility of the well location.

One extension to the definition of NORP oil (New Oil Reference Price) was approved in 1983 and consideration was under study for another. Thirty-five applications were approved during the year, 21 for well locations outside the original NORP outlines and 14 for wells where production was shut in over three consecutive years. Another federal government scheme was supported by the section, by provision of required well information in connection with the Petroleum Incentive Program.

A second six-month production period was examined to determine the Province's oil capability. Although the individual well data did not match those calculated from the first study done in 1982, the same approximate production efficiency of 75 per cent was determined as a provincial average.

No progress was made in 1983 in the project to modify the Petroleum Reporting System which compiles production data, although substantial advances were made to computerize the royalty calculations made by the Mineral Revenue Branch.

**Drilling and Production Section (District Operations)**

The District Office is located at Charlie Lake, in the Peace River area of northeastern British Columbia. During 1983 staff drove over 346,000 kilometres around the province to enforce field aspects of the Drilling and Production, Geophysical, and Geothermal Regulations.

To ensure that safety in operations was maintained, inspections were carried out on 197 occasions at active drilling sites. Continuance of the program initiated in 1982, to reclaim abandoned well sites and maintain

acceptable conditions at all production sites, resulted in a total of 9,095 inspections.

A further 2,128 inspections at oil and gas batteries were necessary to continue the oil well productivity study, to make environmental assessments regarding ambient air monitoring, and to assure compliance with gas conservation orders and that good engineering practices were followed.

Monitoring of the accuracy of gas measurement equipment continued throughout the year with fast meter checks done on 1,468 occasions and complete meter checks done 1,572 times.

To confirm the reliability of subsurface pressure data supplied to the division by industry, there were 1,922 calibrations performed on subsurface pressure gauges using the British Columbia standard dead weight tester. To further ensure reliability of the subsurface data, the British Columbia tester was calibrated against its Alberta counterpart, with results within acceptable limits.

To supplement data required by the Reservoir Engineering Section, 39 static pressure gradients were run and 237 oil and 124 gas well tests were witnessed.

Geophysical field activity remained at a moderate level, very similar to 1981 and 1982. Inspections on geophysical operations were carried out 151 times during the year.

Inspection of salt water disposal systems and the witnessing of segregation tests were emphasized during 1983.

The District Office continued its involvement as co-chairman of the Northeastern British Columbia Oil Spill Co-operative, and as the provincial representative on PROSCARAC (Prairie Regional Oil Spill Containment and Recovery Committee), taking an active role at all meetings and training exercises.

In September, a training exercise of the co-operative was held at Charlie Lake. The OSCAR (Oil Spill Containment and Recovery) trailer and equipment were deployed to clean up a simulated oil spill from the lake. Raw canola oil was used in the simulated spill and recovery was virtually 100 per cent. The results of this exercise were important as the lake is the source of water for the city of Fort St. John, and a real spill with ineffective cleanup would be very damaging to the industry's community relations.

During 1983, a project was initiated at the District Office to issue Certificates of Restoration to as many

abandoned well sites as possible. This project involves reinspection of nearly 2,500 sites to confirm that final reclamation was done. Commencing in June, approximately 1,600 of these sites were inspected. About 1,000 of them were done by helicopter while the remaining were ground inspections utilizing four-wheel-drive or all-terrain vehicles. It was observed that about 300 sites required additional reclamation work. During the year, 841 Certificates of Restoration were issued.

To improve safety and work efficiency in the field, methods were examined to improve the radio communication system between the District Office and the inspection technicians. This study took advantage of the latest advances in radio communications and resulted in the purchase of 36-channel programmable field radios plus a base station located at the District Office.

During 1983 the District Office was involved in various projects. Contributions were suggested for amendments to the Drilling and Production Regulation regarding electrical installation and pollution control. Revisions were made to the published wellsite construction guidelines and regulations were under preparation for well servicing blowout prevention. Investigation of the ambient air quality within a 30-mile radius of the city of Fort St. John continued during the year.

**Reservoir Engineering Section**

An important responsibility of the Reservoir Engineering Section is to estimate, on a continuing basis, the oil and gas reserves in British Columbia. These reserves, as of December 31, 1983, are summarized as:

| | | | |
|---|---|---|---|
| Oil, established ..... | 23,515.2 | $10^3m^3$ | (147,978.1 MSTB) |
| Natural gas, established - | | | |
| Raw ..... | 292,338 | $10^6m^3$ | ( 10,376.2 BSCF) |
| Marketable ..... | 238,622 | $10^6m^3$ | ( 8,469.6 BSCF) |
| Natural gas, liquids - | | | |
| Propane ..... | 1,498.3 | $10^3m^3$ | ( 9,439.3 MSTB) |
| Butanes ..... | 2,218.8 | $10^3m^3$ | ( 13,791.4 MSTB) |
| Pentanes Plus ..... | 4,324.1 | $10^3m^3$ | ( 27,211.0 MSTB) |
| Sulphur ..... | 11,250.4 | $10^3t$ | ( 11,072.7 MLT) |

Note:
- MSTB = thousand stock tank barrels
- BSCF = billion standard cubic feet
- MLT = thousand long tons
- $10^3m^3$ = 1,000 cubic metres
- $10^6m^3$ = 1,000,000 cubic metres
- $10^3t$ = 1,000 tonnes

A study group on the marketing of British Columbia natural gas completed a broad review of the systems of

developing and marketing natural gas in British Columbia, Alberta, and Saskatchewan. The study group consisted of various ministry staff and was chaired by Dr. George W. Govier. Engineering staff from the division assisted the study group by defining reservoir parameters that were critical in establishing an economically feasible and practical new gas royalty system.

The Reservoir Section devoted considerable effort to the preparation of a submission to the National Energy Board entitled *Supply of Crude Oil, Natural Gas and Natural Gas Liquids in British Columbia*. This report contains forecasts of natural gas, natural gas liquids and crude oil producibility for the period 1983-2005. The oil producibility forecast contains estimates of future additions due to drilling, water-flood modifications and tertiary schemes.

A screening procedure to determine which pools would be suitable for a tertiary scheme was completed. It was estimated that the province has the potential to recover an additional 20 million cubic metres of reserves from existing oil fields which would not be recovered by conventional primary and secondary techniques. Approximately 90 per cent of potential tertiary oil would be recovered using miscible flooding techniques. Sources of supply of carbon dioxide and light hydrocarbons from Fort St. John and Fort Nelson gas plants were examined, and it was determined that they have an adequate supply of injection fluids for miscible flooding.

Analyses are being completed to assess the economic feasibility and required government policies to promote the development of tertiary oil recovery from oil fields in the province.

# Geological Branch

The Geological Branch is responsible for collecting geological and geophysical information on the petroleum and geothermal resources of the province. Branch staff make estimates of the potential of undiscovered resources and provide advice that assists the petroleum industry in its exploration and development activity.

**Economic Geology Section**

Major projects in 1983 included publication of a map showing the geothermal potential of British Columbia, and the completion for publication of a series of regional stratigraphic cross-sections of the northeastern oil- and gas-producing region of the province. The geothermal map, compiled in collaboration with the Mineral Resources Division, combines information on geothermal gradients from deep drill holes with available data on thermal springs, young volcanic centres and the geotectonic setting of the province. The Neogene volcanic deposits of the central interior region and the Devonian reef structure of the northeast are added to the map because of the anticipated and known warm water reserves of these rocks.

A series of cross-sections was compiled as a means of assisting resource evaluation work and the promotion of industry activity. These sections have been constructed in an attempt to render an integrated stratigraphic picture of Middle Devonian reef and off-reef environments and regional relationships of the overlying Upper Devonian in northeastern British Columbia. The study has employed wireline logs and information from the division data files. These sections, in concert with published information in adjacent areas, will provide valuable background data for use in assessing the hydrocarbon potential of the northeast.

As a result of work completed in 1982, the Geological Survey of Canada made available its Open File Report 921 entitled *Source Rock-Oil Shale Potential of the Jurassic Kunga Formation, Queen Charlotte Islands*. The project was partially funded by the ministry and involved a detailed chemical analysis of approximately 300 shale samples taken from two locations on Graham Island. The study concluded

that the oil shale potential of the sampled areas, although encouraging, is not definitive at this time.

A meeting with other agencies and private sector interests was held to provide coordination with the program of the federal government for the assessment of the geothermal resource potential of British Columbia. It was concluded that any expenditure of geological assessments and research at this time would be to provide basic knowledge of the resource potential and the requirements for its development, so the economics can be assessed and the resource developed effectively when requirements change.

Numerous meetings with representatives of industry were held on matters concerning resource potential and exploration procedures in the province. These included discussions on the disposition of geothermal rights in the Garibaldi Volcanic Belt area of southern British Columbia; the drilling of stratigraphic test holes on Graham Island; the drilling for conventional natural gas and natural gas associated with coal formations on Vancouver Island; and the prospects of finding oil and gas in the area south of Cranbrook as a result of geophysical and exploratory drilling activity in the state of Montana.

**Geophysical Section**

Project work continued during the year with the integration of non-confidential seismic data into existing subsurface mapping coverage. This revised and updated mapping is made available through publication and is used extensively by industry in developing drilling prospects and assessing lands posted for the disposition of Crown petroleum and natural gas rights by public tender.

The Geophysical Section, in coordination with Economic Geology, was responsible for the assessment of a number of land use proposals with reference to their petroleum and geothermal resource potential. These proposals by other government agencies are carefully checked in order to protect the right to explore and develop lands considered to have potential oil, gas and/or geothermal resources.

**Reservoir Geology Section**

Although 1983 drilling activity showed a 30-per-cent reduction from 1982, the Reservoir Geology Section carried out a comprehensive program of assessment and mapping in detail of all oil and gas accumulations encountered by the drill. Structural, stratigraphic, and reservoir geologic data made available through drilling are used as a basis for

new and revised map constructions, reservoir studies, evaluation of reserves and the control of remedial work, recycling, repressuring and secondary recovery projects.

One major assignment for the section was the preparation of geological summaries and tabulation of characteristics of 18 oil reservoirs for an analysis related to possible enhanced oil recovery (EOR) schemes. Also completed was a review of 15 pools to determine why they had substantial hydrocarbon reserve discrepancies when compared to those of other agencies. Maps, cross-sections, and reservoir data tabulation of the Helmet-Slave Point 'A', Helmet North-Slave Point 'A', Clarke Lake-Slave Point 'A' and Parkland-Wabamun 'A' gas pools were prepared for the forthcoming Canadian Society of Petroleum Geologists publication *Oil and Gas Pools in Canada*.

Many lease strata title determinations and related productive zone identifications were processed, and routine assistance was provided in advising other branches on geological assessment of Crown lands posted for disposition of Crown petroleum and natural gas rights, and for petroleum and natural gas lease continuations; reclassification of wells for the purpose of confidentiality and new pool discovery status; and appraisals concerning industry production schemes, such as concurrent production and good engineering practice, plus the disposal of water production and surplus mud.

# Petroleum Titles Branch

The Titles Branch is responsible for administering laws and regulations affecting the title and disposition of Crown petroleum and natural gas rights, including any approved underground storage programs.

Out of 110 parcels of oil and gas rights awarded at five dispositions held during 1983, 28 parcels were located in the Desan oil area. The tender bonuses received from these 28 parcels represented approximately 50 per cent of the total received during the year. Tender bonuses for 1983 totalled $26,014,217, compared with $16,724,133 in 1982.

Geophysical exploration in 1983 remained at approximately the same level as in 1982. Sixty-five programs were completed, compared to 73 in the previous year. A total of 97 programs were approved, including 18 carried over from 1982. During the year four were cancelled and, at year's end, 10 had not commenced.

In 1983, there was a total of 3,516 kilometres of seismic line recorded, compared to 4,055 kilometres during 1982.

At December 31, 1983, there were 8,709,827 hectares of oil and gas rights held under 7,901 various forms of title. This compares to 11,664,169 and 8,221 respectively at the end of 1982. The majority of the decrease in total holdings occurred with the surrender of 53 permits containing 2,174,217 hectares of oil and gas rights located in the Nechako Basin area of the province.

# Offshore Administration Branch

Planning activities and discussions related to the possible resumption of offshore petroleum exploration progressed during 1983.

Early in the year, negotiations were initiated with the Canada Oil and Gas Lands Administration of the federal government on environmental planning for a possible resumption of exploration off the coast of British Columbia. As a result of these negotiations, an agreement was signed on September 8, 1983, whereby the provincial and federal governments made a commitment to cooperate in a joint review of the effects of environmental and directly related socio-economic implications of offshore petroleum exploration. This agreement is without prejudice to questions of ownership or jurisdiction.

The area covered by the agreement extends north of Vancouver Island in Hecate Strait/Dixon Entrance to the B.C.-Alaska border. Although there are no active provincial permits in the area, the province has accepted Chevron Canada Resources Ltd. and Petro-Canada Inc. as the designated companies with an interest in renewing offshore exploration to provide background information for the purposes of the review.

Chevron and Petro-Canada submitted Initial Environmental Evaluations (IEEs) to both governments. These studies, in addition to a Preliminary Environmental Assessment prepared by the provincial Ministry of Environment, will form the information base for the review.

Under the terms of the agreement, the Ministry of Energy, Mines and Petroleum Resources and the Canada Oil and Gas Lands Administration were required to conduct a technical evaluation of these IEEs in cooperation with the provincial Ministry of Environment and the federal Departments of Environment and Fisheries and Oceans. The purpose was to assess the IEEs in terms of adequacy, competence and completeness to provide the required background information for the public review. Planning for this technical evaluation took place in the latter part of the year.

The IEEs were also distributed widely among coastal community libraries and interest groups. Notification of their availability and the intent to seek public comment at a later date were published in coastal community newspapers.

In accordance with the agreement, a five-member panel was to be appointed to hold a formal public review and to make recommendations to the federal and provincial Ministries of Environment on the terms and conditions under which offshore petroleum exploration might proceed in a safe and environmentally responsible manner, should the decision be made to renew exploratory drilling activity. The review will be administered jointly under the provincial *Environment Management Act* and the federal Environmental Assessment Review Process.

During the year communication with coastal communities, public interest groups, and the petroleum industry was maintained, as well as liaison with other federal and provincial departments with an interest in renewed offshore exploration activity.

The branch was discontinued in April but its functions continued to be coordinated by the office of the Assistant Deputy Minister.

# Mediation and Arbitration Board

The Mediation and Arbitration Board is established under the *Petroleum and Natural Gas Act* to facilitate negotiations between petroleum companies and landowners regarding access to petroleum-bearing lands. The board has the responsibility and authority to:

- grant Right of Entry to oil and gas companies over lands where the landowner has refused access;
- determine the conditions for Right of Entry and establish compensation to be paid to the landowner;
- appoint a member of the board to act as mediator between a petroleum company and a landowner when an impasse develops regarding Right of Entry;
- convene an arbitration hearing, if mediation proves unsuccessful, where evidence and exhibits can be received from landowners and petroleum companies before compensation for Right of Entry is determined regarding wellsite, campsite, roadway and/or pipeline installations;
- conduct arbitration hearings, when requested, to review and set annual rental on leases and previous board orders of more than five years duration;
- terminate Right of Entry when a petroleum company ceases to occupy land and a Certificate of Restoration has been issued by the Ministry; and
- amend or rescind board orders as circumstances and conditions dictate.

The board conducted numerous on-site inspections in 1983. The inspections covered proposed new Rights of Entry for the purposes of drilling or laying flowlines, and at existing well or pipeline locations where some particular problem came to the board's attention at the request of a surface owner.

The number of new Rights of Entry and arbitration cases decreased from the previous year. This was due partly to the continued decline in field activity, but also as a direct result of increased emphasis by the board in resolving potential conflicts by mediation.

The mediation procedure is proving to be a successful method of resolving many conflicts at an informal level, thus reducing the number of disputes that require settlement by arbitration. The board views this development as a positive benefit to both surface and subsurface owners.

Composition of the board was unchanged in 1983: D. (Ed) Smith, chairman; Cecil Ruddell, vice-chairman; John Martin and John Strain, members.

# FINANCE AND ADMINISTRATION DIVISION

The Finance and Administration Division is responsible for providing financial and administrative services in support of the ministry's policies and programs. It also manages the assessment and collection of taxes and royalties prescribed in a variety of legislation administered by the ministry.

# Mineral Revenue Branch

The Mineral Revenue Branch is responsible for the administration of mineral and petroleum resource taxes and royalties assessed under the *Mineral Resource Tax Act*, *Mineral Land Tax Act*, Coal Royalty Regulations and the Petroleum and Natural Gas Royalty Regulations.

The branch also administers the Petroleum Pricing and Compensation Programs entered into under the Canada/British Columbia Agreement of September 24, 1981.

Revenue collections in 1983 increased by 11 per cent, to $109.6 million from the $98.4 million collected in 1982. This is still 24 per cent below the record year of 1980 when revenues reached $144.8 million. Although coal, petroleum and mineral land tax revenues reflected an overall increase of 15 per cent over the previous year, mineral resource tax revenues declined to a negative position as a result of the continued weakness in metal prices on the world market. A complete listing of all revenues collected by the branch appears in Table 1, Revenue to the Crown.

# Financial Services Branch

The Financial Services Branch provides financial administrative support to all sections of the ministry. It is responsible for preparing budget estimates, providing payroll services and administering all supplier accounts.

Activity within the branch has remained at a high level, with a transaction volume slightly above that experienced in 1982.

Automation of the financial system, with related system development and programming, continued through 1983. The system was partially operational at year's end, with completion scheduled for late 1984.

# Administration and Publications Branch

The Administration and Publications Branch is responsible for acquiring and servicing ministry property, including office space, vehicles, telecommunications and office support equipment. It also manages ministry-wide mail and courier services, and is responsible for production and distribution of the many technical, administrative and public information publications issued by the ministry.

During 1983 the branch continued cost reduction programs for administrative overhead. In addition, incentive measures were introduced to reduce overall postal service cost and the ministry vehicle fleet was reduced by 29 units.

Several District Offices were closed in 1983. The Portfolio Review Savings Program initiated space reductions and lower operation and maintenance charges.

Also during the year the representative to the Ministry of Labour Women's Programs Advisory Group prepared a 12-month action plan, including recommendations for career counselling and advancement programs.

# Data Services Branch

Specialized support of ministry information processing programs is provided by the Data Services Branch in accordance with a five-year strategic plan to implement ministry-wide data-processing operations integrated with office automation systems. The branch is the ministry's prime interface with the services of the British Columbia Systems Corporation.

The branch is now entering the third year of its plan and 1983 saw the onset of a major project in the automation of the Petroleum Titles and Mineral Titles administration systems. These systems will form the foundation of information flow across the province. Data is currently being entered at a pilot level and implementation of the pilot project is anticipated around the end of 1984.

In addition, the Titles administration systems drive several geological sub-systems which includes a mineral inventory system, currently under way, and an automated mapping program which is being standardized to merge with a provincial mapping program.

Computer support is also being provided to the Energy Resources Division for econometric modelling and implementation of projects in conjunction with the B.C. Utilities Commission.

# Personnel Services Branch

Personnel Services Branch played a key role in implementing the ministry's contingency plan during the 1983 work stoppage by government employees, and in applying the government's Staff Restraint Program across the ministry, in addition to normal activities.

In the labour relations area, grievances were at a very low level, consistent with past years.

Training and development, covering 150 staff, accounted for 350 training days. An audit of the ministry's safety programs was commenced and outdoor survival training given to field staff. A seminar covering the safe operation of video display terminals was also presented.